

Table of Content PCIM Europe 2021

Keynote

- K01** **Next-Generation SiC/GaN Three-Phase Variable-Speed Drive Inverter Concepts**
Johann Walter Kolar, ETH Zürich, CH
- K02** **Next Generation of Power Electronics Module Packaging**
Hannes Stahr, AT&S, A
- K03** **HVDC Grid Challenges Locks and Opportunities**
Seddik Bacha, SuperGrid Institute, F

SiC Devices I

- 001** **Parallel SiC Power Modules for the Use in High Current 3 Level ANPC Inverters with High Requirements on Output Frequency and THDi**
Martin Kroschk, Gunther Budig, André Nickel, EAAT, D
- 002** **Challenges in Scaled High-Current SiC Measurements**
Jan Fuhrmann, Felix Kayser, Hans-Günter Eckel, Hao Wang, University of Rostock, D
- 003** **Fast SiC-MOSFET Switch with Gate Boosting Technology**
Martin Sack, Martin Hochberg, Dennis Herzog, Georg Müller, Karlsruhe Institute of Technology, D
- 004** **A Unified View of GaN, SiC, Silicon FETs & IGBTs and their Price-Performance Analysis**
Shishir Rai, DiscoverEE , USA

Power Electronics Simulation I

- 005** **Fixed Admittance Matrix Technique for Real Time Power Electronics Simulation on Matlab/Simulink**
Samir Salama, Simupec, D
- 006** **Separation of Models for the Distributed Simulation of Electric Grids**
Wilfried Holzke, Florian Redmann, Matthias Joost, Bernd Orlik, University of Bremen, D
- 007** **Challenges of Commutation Cell Tests with Voltage Source Inverters in Power-Hardware-in-the-Loop Simulations**
Marc René Lotz, Technical University of Braunschweig, D; Martin Könemund, Ostfalia University of Applied Sciences, D
- 008** **Novel Approach to Model GaN-HEMT Capacitances using Sigmoid Functions**
Julian Dobusch, Raffael Schwanninger, Thomas Duerbaum, Friedrich-Alexander-University Erlangen-Nuremberg, D

Power Modules I

- 009** **Consideration of Oscillation Dilemma from Dual 3.3 kV and 6.5 kV High Voltage Common Package**
Taiga Arai, Takashi Wada, Masashi Ohara, Koji Sasaki, Daisuke Kawase, Hitachi Power Semiconductor Device, J; Akira Mima, Tomoyasu Furukawa, Hitachi, J
- 010** **Reduction of Parasitic Inductance and Thermal Management in a Multichip SiC Half-Bridge Module**
Tobias Nieckula Ubostad, Andreas Giannakis, Gard Lyng Rødal, Daniel Alexander Philips, Dimosthenis Pefitsis, Norwegian University of Science and Technology, N
- 011** **Faster Switching with Less Overvoltage - Limitations in Current, Parasitics and Paralleled Chips**
Pablo Rodriguez de Mora, Mark-M. Bakran, University of Bayreuth, D
- 012** **Full Bridge SiC Module for Charger Applications**
Max-Josef Kell, Jorge Mari, Matthias Beck, Jörg Bergmann, Danfoss Silicon Power, D

SiC Devices II

- 013** **Investigation of Performance of Double-Trench SiC Power MOSFETs in Forward and Reverse Quadrant Operation**
Juefei Yang, Saeed Jahdi, Bernard Stark, Phil Mellor, University of Bristol, GB; Olayiwola Alatise, Jose Ortiz-Gonzalez, University of Warwick, GB
- 014** **Analysis of Dynamic Transients of High Voltage Silicon and 4H-SiC NPN BJTs**
Chengjun Shen, Saeed Jahdi, Phil Mellor, Xibo Yuan, University of Bristol, GB; Olayiwola Alatise, Jose Ortiz-Gonzalez, University of Warwick, GB
- 015** **Analysis of a 3.3kV-Si-SiC-Topology-Hybrid-Switch for Resonant ZVS Inverter Applications**
Michael Meissner, Klaus Hoffmann, Helmut Schmidt University, D
- 016** **Analyzing Spectral Electroluminescence Sensitivities of SiC MOSFETs and their Impact on Power Device Monitoring**
Lukas A. Ruppert, Sven Kalker, Rik W. De Doncker, RWTH Aachen University, D; Christoph H. van der Broeck, FEV Europe, D

Power Electronics Simulation II

- 017** **Simplified Method to Analyze Drive Strengths for GaN Power Devices**
Enis Baris Bulut, University of Trakya, TR; Mehmet Onur Gulbahce, Fatih Sultan Mehmet Vakif University, TR; Derya Ahmet Kocabas, Istanbul Technical University, TR; Serkan Dusmez, Arçelik, TR
- 018** **Model Parameter Extraction Tool for the Analysis Series-Connected SiC-MOSFETs**
Cédric Mathieu de Vienne, Besar Asllani, Bruno Lefebvre, SuperGrid Institute, F; Pierre Lefranc, Pierre-Olivier Jeannin, G2elab, F
- 019** **Investigations on Calculation Time Reduction in Numerical Simulations for Power Electronic Applications**
Marcel Gladen, WILO, D

- 020** **A High-Speed and High-Accuracy SiC MOSFET Model for Simulating Practical Power Circuits**
Yohei Nakamura, Naotaka Kuroda, Atsushi Yamaguchi, Ken Nakahara, ROHM, J

Power Modules II

- 021** **Wire Bonding Stress Analysis Under Short-Circuit Tests for SiC MOSFETs**
Mario Pulvirenti, Daniela Cavallaro, Luciano Salvo, Angelo Giuseppe Sciacca, Marco Papaserio, Alessandra Cascio, STMicroelectronics, I
- 022** **Smart Package Upgrade to Improve Power Density and Lifetime in Heavy-Duty Vehicles**
Stefan Buschhorn, Klaus Vogel, Max Jacobs, Andreas Schmal, Infineon Technologies, D
- 023** **Comprehensive Analysis of the Impact of Serial and Parallel Cooling on the Thermal Performance of Power Semiconductor Modules**
Lluís Santolaria, Milad Maleki, Athanasios Mesemanolis, Antoni Ruiz, Edoardo Ceccarelli, Hitachi ABB Power Grids, CH
- 024** **Active Short Circuit Capability of Half-Bridge Power Modules Towards E-Mobility Applications**
Antoni Ruiz, Athanasios Mesemanolis, Milad Maleki, Lluís Santolaria, Andreas Baschnagel, Hitachi ABB Power Grids, CH

Multilevel Converter

- 025** **Evaluation of Quasi 2-level Modulation for MV Applications**
Anatolii Tcai, Thiwanka Wijekoon, Huawei, D; Marco Liserre, Christian-Albrechts-University, D
- 026** **Design and Testing of a Novel Transcranial Magnetic Stimulator with Adjustable Pulse Dynamics and High Current Capability (>2 kA) based on a Modular Cascaded H-Bridge Inverter Topology**
Florian Schwitzgebel, Manuel Kuder, Thomas Weyh, Bundeswehr University Munich, D; Christina Meisl, Charité Universitätsmedizin Berlin, D; Anton Kersten, Chalmers University of Technology, S
- 027** **A Novel Cell-By-Cell Pre-Charge Scheme for Modular Multilevel Converters**
Ilknur Colak, Maschinenfabrik Reinhausen, D; Mohammad Abu-Ali, Technical University of Munich, D
- 028** **Development and Testing of Protection Concepts for Modular Multilevel Converters using Back-to-Back Operation**
Waqas Ali, Balduino Rabelo, Maschinenfabrik Reinhausen, D

Converter Design Optimization

- 029** **Design of Sensors for Real-Time Active Electromagnetic-Emission Control in SiC Traction Inverters**
Jochen Henn, Carsten Fronczek, Rik W. De Doncker, ISEA RWTH Aachen University, D
- 030** **Distributed Control for the Current Balancing of a Multiphase Converter using a Single Voltage Sensor**

Marc Cousineau, Thierry Meynard LAPLACE, F; Victor Flores Mendes, Seleme Isaac Seleme Jr., Federal University of Minas Gerais, BR; Joao Lucas Da Silva, Federal University of Itajubá, BR

- 031** **Comparing Preisach and Jiles Atherton based Models for Ability of Loss Prediction**
Matthias Köppen, Jörn Schliewe, Stefan Scheffler, Stefan Weber, TDK Electronics, D
- 032** **Tubular Electronics – Next Step in System Integration**
Paul Gierth, Lars Rebenklau, Fraunhofer Institute IKTS, D

Power Modules III

- 033** **Benefits of Using the New 1700V and 3300V High Power Modules for Traction Applications**
Miroslav Hruska, Siemens, CZ; Praneet Bhatnagar, Hitachi, GB; Michael Slevin, Hitachi Europe, D
- 034** **Assembly Technologies for Highly Integrated Sandwich Type Power Modules with WBG Semiconductors**
Ulrich Keßler, Martin Rittner, Tine Konjedic, Robert Bosch, D
- 035** **Development of the Laser Beam Based High-Current Contacting Technology and an Integrated Lead Frame Stack Structure**
Woo-Sik Chung, Johanna Helm, Alexander Olowinsky, Fraunhofer Institute ILT, D; Markus Bast, Jan Philipp Gördes, Ronald Eisele, University of Applied Sciences Kiel, D; Martin Becker, Frank Osterwald, Danfoss Silicon Power, D; Christian Schellenberg, Klaus Wilke, Siemens, D
- 036** **Application and Verification of Effective Heat Spreading Angles on a Multi-Layer Thermal Design**
Robin Weiß, Sebastian Rode, Normann Schwingal, Tobias Barth, Steffen Bernet, Technical University of Dresden, D

SiC Devices and Applications

- 037** **An Alternative Approach to Parasitic Turn On Detection**
Jorge Mari, Max-Josef Kell, Fabio Carastro, Danfoss Silicon Power, D
- 038** **Understanding the Turn-off Behavior of SiC MOSFET Body Diodes in Fast Switching Applications**
Paul Sochor, Andreas Hürner, Michael Hell, Rudolf Elpelt, Infineon Technologies, D
- 039** **Influence of the Threshold-Voltage Hysteresis on the Switching Properties of SiC MOSFETs**
Andreas Hürner, Paul Sochor, Rudolf Elpelt, Maximilian Wolfgang Feil, Infineon Technologies D
- 040** **Comparison of Three Methods [Gate Bias Reduction, Series Ballast Resistor and BaSiC(EMM) to Improve Short Circuit Capability of 1.2 kV SiC Power MOSFETs**
Ajit Kanale, Jayant Baliga, North Carolina State University, USA

Special Session: Materials Development for Power Electronics

- 041** **The Long Journey from Crystal Growth to Power Devices, the Role of Material Development for III-Nitride Semiconductors**
Elke Meißner, Sven Besendörfer, Sepideh Faraji, Fraunhofer Institute IISB, D; Eldad Bahat-Treidel, Joachim Würfl, Ferdinand-Braun-Institute Berlin, D
-  **042** **Challenges of New Packaging Solutions for Power Modules**
Ronald Eisele, University of Applied Sciences Kiel, D; Anton Miric, Heraeus Materials Technology, D; Markus Scheibel, Heraeus Deutschland, D
- 043** **New Aspects in the Understanding of High Voltage Aluminium Electrolytic Capacitors**
Thomas Ebel, Steffen Buhrkal-Donau, William Greenbank, Vladimir Bordo, Kiril Bordo, University of Southern Denmark, DK
- 044** **Current State and Development Trends of Insulation Systems in BEV Traction Motors Steered by Electric Powertrain Innovation**
Kraun Bae, Robert Plikat, Christiane Besch, Zdeno Neuschl, Volkswagen, D; Martino Bailoni, Benjamin Gaussens, Dupont de Nemours, CH; Alexander Litinsky, Frank Saborowski Axalta Coating Systems, A; Michael Kurrat, Technical University of Braunschweig, D

Energy Storage Systems

- 045** **Electro-Thermal Battery Model for Automotive Applications**
Yasser Ghoulam, Tedjani Mesbahi, Sylvain Durand, Christophe Lallement, INSA Strassbourg, F
- 046** **Infini-Cell: Bus Bar for Battery Cell Interconnection**
Thomas Fouet, Pierric Gueguen, Mersen, F
- 047** **Series Connection of 10 kA Switches with MOSFETs in Avalanche Mode for Short Circuit of Lithium-Ion Batteries Abusive Tests**
Daniel Chatroux, Julien Chauvin, CEA, F
- 048** **Utilization Increase of Stationary Energy Storage Systems Through the Use of Multiple Application Possibilities for Economic Integration for Industrial Electricity Customers**
Lukas Böhning, Ulf Schwalbe, Timo Möller, University of Applied Sciences Fulda, D

High Frequency Switched Mode Power Supplies

- 049** **Self-Oscillating Very High Frequency Inverter for Gate Driver Power Supply**
Andreas Kieninger, Eckart Hoene, Fraunhofer Institute IZM, D
- 050** **High Power Gan Module Using 3D-Printed Liquid Coolers for Hard-Switching at Megahertz**
Björn Pelle Weiler, Bas Vermulst, Erik Lemmen, Korneel Wijnands, Technical University of Eindhoven, N
- 051** **Modulation Scheme for a ZVS Clamp-Switch Operated Three-Level Flying Capacitor Buck Converter**
Burkhard Ulrich, Baden-Wuerttemberg Cooperative State University Stuttgart, D

- 052** **Bi-Directional 1/16th Brick Converter Using Monolithic GaN Power Stage**
Michael de Rooij, Yuanzhe Zhang, Efficient Power Conversion, USA; Andreas Reiter, Microchip Technology, D

GaN Devices

- 053** **Design of Low-Resistance and Area-Efficient GaN-HEMTs for Low-Voltage Power Applications**
Richard Reiner, Fouad Benkhelifa, Stefan Moench, Michael Basler, Patrick Waltereit, Micheal Mikulla, Rüdiger Quay, Oliver Ambacher, Fraunhofer Institute IAF, D



- 054** **A Three-Phase GaN-on-Si Inverter IC for Low-Voltage Motor Drives**
Stefan Moench, Richard Reiner, Fouad Benkhelifa, Michael Basler, Patrick Waltereit, Rüdiger Quay, Fraunhofer Institute IAF, D

- 055** **A High Precision Dynamic Characterization Bench with a Current Collapse Measurement Circuit for GaN HEMT Operating at 175°C**
Van Sang Nguyen, Jeremy Martin, Stephane Catellani, Charlotte Gillot, René Escoffier, Anthony Bier, CEA, F

High Power Converters

- 056** **New Multi-Level Multiplexed Power Converter Topology for Medium-Voltage Power Drives**
Vinicius Kremer, Alain Lacarnoy, Schneider Electric, F; Thierry Meynard, LAPLACE University of Toulouse, F

- 057** **Study of Insulating Properties for HV Power Modules**
Tingting Wang, Bing Luo, Yongsheng Xu, China Southern Power Grid Research Institute, CHN; Fang Qi, Liang Yao, Liang Zeng, Coresing Semiconductor Technology, CHN

- 058** **Virtual Capacitor Concept for Effective Real-Time MMC Simulations**
Stefan Milovanovic, Drazen Dujic, Power Electronics Laboratory, EPFL, CH; Min Luo, Plexim, CH

Sintering Technology

- 059** **Examining Ag-Ag Direct Bonding on Chemically Coated DBC Substrates as a Pasteless Die-Attach Approach**
Felix Häußler, Jörg Franke, Jakob Schöttner, Johanna Schubert, Martin Muckelbauer, Erdmann Spiecker, Friedrich-Alexander-University Erlangen-Nuremberg, D



- 060** **Copper Sintering Pastes for Die Bonding**
Hideo Nakako, Toshiaki Tanaka, Michiko Natori, Dai Ishikawa, Yoshinori Ejiri, Showa Denko Materials, J

- 061** **Bonding Properties of Cu Sinter Paste for Pressureless Sintering Process**
Shinichi Yamauchi, Satoshi Konno, Takashi Hattori, Kei Anai, Mitsui Mining & Smelting, J

High Frequency Power Converters

- 062** **Transient Behavior of an 800 kHz 9-level Single-Phase Flying Capacitor GaN Multilevel Inverter**
Raphael Hartwig, Alexander Hensler, Siemens, D; Thomas Ellinger, Technical University of Ilmenau, D
- 063** **Three-Channel Interleaved Totem Pole PFC in Triangular Current Mode (TCM) with STM32G474 Microcontroller**
Marco Torrisi, Sebastiano Messina, STMicroelectronics, I
- 064** **Lossless Hard-Commutated Operation of SJ MOSFETs and Application to CCM Totem-Pole Bridgeless PFC**
Rafael Antonio Garcia Mora, Matteo-Alessandro Kutschak, David Meneses, Manuel Escudero, Infineon Technologies, A

SiC Devices III

- 065** **A Flexible Test Setup for Long-Term Dynamic Characterization of SiC MOSFETs under Soft- and Hard-Switching Conditions**
Daniel Philipps, Dimosthenis Peftitsis, Norwegian University of Science and Technology, N
- 066** **Parallel Operation of SiC MOSFETs**
Yuequan Hu, Jianwen Shao, Wolfspeed, A Cree Company, USA
- 067** **SiC Power Device Evolution: Characteristics Analysis and Performance Comparison of Gen2 and Gen3**
Anselmo Gianluca Liberti, Maurizio Melito, Domenico Paternostro, STMicroelectronics, I
- 068** **A Novel Trench SiC-MOSFETs Fabricated by Multiple-Ion-Implantation into Tilted Trench Side Walls (MIT2-MOS)**
Katsutoshi Sugawara, Yutaka Fukui, Rina Tanaka, Kohei Adachi, Yasuhiro Kagawa, Shingo Tomohisa, Naruhisa Miura, Eisuke Suekawa, Yoshiaki Terasaki, Mitsubishi Electric Corporation, J

Smart Energy Distribution I

- 069** **Experimental Evaluation of a Decentral Multi-Terminal DC Grid Controller with Needs-Based Power Flow**
Steffen Menzel, René Reimann, Wilfried Holzke, Holger Raffel, Bernd Orlik, University of Bremen, D
- 070** **Simulating the Black Start of an Isolated Grid with Previously Stored Wind Energy**
Antonio Mielach, Florian Redmann, Bernd Orlik, Holger Raffel, University of Bremen, D
- 071** **Evaluation of a Control Strategy for Meshed Offshore DC Grids in Floating-point and Fixed-point Arithmetic**
René Reimann, Steffen Menzel, Wilfried Holzke, Holger Raffel, Bernd Orlik, University of Bremen, D
- 072** **Simulation and Verification of Solid-State Breakers for Low Voltage Applications**
Ara Bissal, Andreas Stiedl, Roland Hümpfner, Jiang Zhengdong, Huawei, D; Shuai Wang, Fugao Zhao, Huawei, CHN

DC-DC Converter I

- 073** **A Novel LED Driver for HID Applications, Compatible with Both EM-ballast and Direct Mains**
Jie Fu, Zhiquan Chen, Shiguang Sun, Gang Wang, Signify Investment, CHN;
Paul Veldman, Dmytro Malyna, Signify, NL
- 074** **Evaluation of Primary-Side MOSFETs Losses in Resonant LLC Converters**
Domenico Nardo, Alfio Scuto, Simone Buonomo, STMicroelectronics, I
- 075** **Series-Resonant-Converter with Galvanic Isolation and >99% Efficiency**
Jörg Bornwasser, Fraunhofer Institute ISE, D
- 076** **Comparison Between Forced CCM and DCM on Low Load Efficiency of a SiC Based DC-DC Converter**
Philipp Hörauf, Friedrich-Alexander-University Erlangen-Nuremberg, D; Achim Endruschat, Martin März, Fraunhofer Institute IISB, D

Packaging Technologies

- 077** **Heat Dissipation Performance Evaluation of Insulated Metal Substrate Based on Transient Analysis**
Si Wei, Zhuzhou CRRRC Times Semiconductor, CHN; Yibo Wu, Haotao Ke, Guozhong Dong, Yueping Deng, Guiqing Chang, Yongdian Peng, Haihui Luo, State Key Laboratory of Advanced Power Semiconductor Devices, CHN; Yangang Wang, Dynex Semiconductor, UK
- 078** **Investigation of Large Area Solder Joints in Temperature Shock Tests**
Constanze Weber, Matthias Hutter, Martin Springborn, Stefan Wagner, Fraunhofer Institute IZM, D; Martin Schneider-Ramelow, Technical University of Berlin, D
- 079** **Effect of EMC Adhesion Strength on Ag Plated DCB by Plasma Treatment**
Miso Park, Hyoung-jun Kim, Man-seok Kwak, KCC, ROK
- 080** **Improvements and Measurements on Power Cycle Test Bench with Blocking and Switching Losses**
Alexey Krupin, Jan Fuhrmann, Hans-Günter Eckel, University of Rostock, D

SiC Devices IV

- 081** **Investigation of 1200 V SiC MOSFETs Switching Performance in 4-pin Package**
Luigi Abbatelli, Giuseppe Catalisano, STMicroelectronics, I
- 082** **Impact of Self-Heating Effect on Plateau Voltage and Gate Charge Measurement for SiC MOSFETs Characterization**
Mario Pulvirenti, Angelo Giuseppe Sciacca, Luciano Salvo, Gionatan Montoro, Massimo Nania, STMicroelectronics, I
- 083** **Hybrid Switch with SiC-MOSFET and Fast IGBT for High Power Applications**
Felix Kayser, Hans-Günter Eckel, University of Rostock, D; Roman Baburske, Philip Brandt, Ute Queitsch, Infineon Technologies, D
- 084** **High Power Density SiC Power Module for Formula E: Requirement, Design Considerations and Test Results**
Milad Maleki, Athanasios Mesemanolis, Lluís Santolaria, Antoni Ruiz, Tobias Keller, Hitachi ABB Power Grids, CH

Smart Energy Distribution II

- 085** **Low Voltage Power Distribution, Moving From Mechanics to Electronics**
Andreas Stiedl, Ara Bissal, Roland Hümpfner, Huawei Technologies Duesseldorf, D
- 086** **An Automatic and Self-Powered Solid-State DC Breaker with Normally-ON SiC JFETs**
Andreas Giannakis, Dimosthenis Peftitsis, Norwegian University of Science and Technology, N
- 087** **Characteristics and Possible Resonant Oscillations in an Open Industrial DC Grid**
Simon Puls, Lenze, D; Slavi Warkentin, Johann Austermann, Holger Borchering, Ostwestfalen-Lippe University of Applied Sciences, D
- 088** **Design of an Adjustable Inductor for a Power Grid Fault Simulator**
Michael Schmidhuber, Herbert Jungwirth, Herbert Maier, SUMIDA Components & Modules, D

DC-DC Converters II

- 089** **A New High-Frequency High-Efficiency GaN TP PFC with Bidirectional ZVS Cell**
Ali Tausif, Technical University of Yildiz, TR; Serkan Dusmez, Arçelik R&D, TR
- 090** **Comparison of Different Inductor Designs based on Litz Wire, Foil and PCB based Windings for DC-DC Converter Operating Into DCM Mode**
Kaspars Kroics, Technical University of Riga, LV
- 091** **Analytical Modelling and Optimization of Gapped Core Magnetics in LLC Converter**
Abdulsamed Lordoglu, Technical University of Yildiz, TR; Mehmet Onur Gulbahce, Fatih Sultan Mehmet Vakif University, TR; Ahmet Derya Kocabas, Istanbul Technical University, TR; Serkan Dusmez, Arçelik, TR
- 092** **High-Efficiency Half-Bridge Module with SiC MOSFETs for High-Power-Density Applications**
Yuequan Hu, Jianwen Shao, Wolfspeed, A Cree Company, USA

Packaging and Reliability I

- 093** **12 kV RCRSD-Based Solid State Switch with Ultra-High Current Rise Rates and High Power Density**
Alexey Khapugin, Viacheslav Muskatinev, Vyacheslav Eliseev, Valentin A. Martynenko, Alexey Grishanin, Dmitriy Nemaev, PJSC Electrovipryamitel, RUS
- 094** **Improving Monitoring of Parallel Ageing of IGBT Bond-Wires and Solder Layers by Temperature Compensation**
Magnar Hernes, Salvatore D'Arco, Ole Christian Spro, Sintef Energy, N; Dimosthenis Peftitsis, Norwegian University of Science and Technology, N
- 095** **Impact of Threshold Voltage Instabilities of SiC MOSFETs on the Methodology of Power Cycling Tests**
Carsten Kemptiak, Andreas Lindemann, Otto-von-Guericke-University, D
- 096** **A New Approach for Detection of Aging of Power Modules by Evaluation of the Magnetic Field**
Michael Wolff, Gerd Griepentrog, Technical University of Darmstadt, D

IPMs, Motion Control and Drives

- 097** **Automated Measurement Procedure for the Characterization of an IPMSM Used for Automotive Applications**
Tobias Röser, Felix Bertele, Christoph Cheshire, Ulrich Ammann, University of Applied Sciences Esslingen, D
- 098** **Safety-Related High-Performance Motion Control based on a Quad-Core SoC**
Timo Wilkening, Jens Onno Krahl, Cologne University of Applied Sciences, D; Matteo Salardi, Intel, I; Freddy Heinzelmann, SEW-EURODRIVE, D
- 099** **Development of a GIT GaN Intelligent Power Module**
Stefan Moser, Maurizio Incurvati, Martin Schiestl, Ronald Stärz, Management Center Innsbruck, A
- 100** **Third Generation of Automotive 650V Intelligent Power Module System for Auxiliary Motor Drive Applications**
Bumseung Jin, Kangyoon Lee, David Jo, Noah Hur, Choonbae Park, ON Semiconductor, ROK; Allan Zhou, ON Semiconductor, CHN

Modeling and Design

- 101** **Modeling and Identification of a Hybrid Motor Cable with a Length-dependent Damping Approach**
Michael Herbst, Franz Maislinger, Leopold Faschang, Goran Stojic, B&R Industrial Automation, A
- 102** **High Speed Hybrid Simulation Engine for Electrical Mission Profiles**
Martin Röblitz, Christopher Schmidt, Arendt Wintrich, SEMIKRON, D
- 103** **A System-Level Design Approach for LLC Converters**
Abdulsamed Lordoglu, Technical University of Yildiz, TR; Mehmet Onur Gulbahce, Fatih Sultan Mehmet Vakif University, TR; Ahmet Derya Kocabas, Istanbul Technical University, TR; Serkan Dusmez, Arçelik R&D, TR
- 104** **Design and Implementation of a Plug-In Repetitive Controller for a High Precision Axis System**
Sebastian Ladenburger, Heinrich Steinhart, Martin Böckler, Swen Bosch, Aalen University of Applied Sciences, D

DC-DC Converter III

- 105** **Characterisation of a 300 kW Isolated DC-DC Converter using 3.3 kV SiC-MOSFETs**
Gustavo Fortes, Philippe Ladoux, Joseph Fabre, Didier Flumian, LAPLACE University of Toulouse, F
- 106** **A 1 kW eGaN FET-Based LLC Resonant Converter in the 1/8th Power Brick Size for 48 V Server Applications**
Michael de Rooij, Jianjing Wang, Amir Negahdari, Yuanzhe Zhang, Efficient Power Conversion, USA
- 107** **Low Inductive Multilayer SiC Power Module for Modular Multiphase DC-DC Converters with Centralized DC-Link**
Thomas Huber, University of Applied Sciences Landshut, D

Packaging and Reliability II

108 **Simulation Based Design of Experiments of Power Cycling Tests Using Die Top System Interconnect Technology Die Topy System (DTS)**
Benjamin Fabian, Sven Thomas, Marko Kalajica, Andreas Hinrich, Christophe Féry, Stefan Gunst, Heraeus Electronics, D

109 **Selection of Test Site Locations for Long-Term Cosmic Radiation Tests**
Leon Fauth, Philipp Mand, Jens Friebe, Leibniz University Hannover, D



110 **Design and Analysis of a PCB Integrated Differential Current Slope Sensor with Ferrite Support for High dV/dt Operations**
Dominik Wimmer, Markus Hutterer, Manfred Schrödl, Technical University of Vienna, A

Innovative Packaging

111 **Si₃N₄ Substrates with Anisotropic Thermal Conductivity Suitable for Power Module Applications**
Teruhisa Okuno, Souhei Arima, Keisuke Tanabe, Gen Tanabe, Yoshiyuki Uchida, Japan Fine Ceramics, J



112 **Asymmetric Packages for Optimal Performance of GaN-HEMT using PCB Fabrication Technology**
Ankit Bhushan Sharma, Till Huesgen, University of Applied Sciences Kempten, D; Ingmar Kallfass, Dominik Koch, Julian Weimer, University of Stuttgart, D

113 **Evaluation of Encapsulation Resin Structure for POL Tile**
Kei Murayama, Amane Kaneko, Mitsuhiro Aizawa, Kiyoshi Oi, Chiaki Fujisawa, Shinko Electric Industries, J

114 **Encapsulation Technology of Epoxy Resin for High Temperature Operating Power Modules**
Yusuke Kaji, Hodaka Rokubuichi, Yutaro Hanawa, Junji Fujino, Koji Yamada, Hiroyuki Harada, Haruo Takao, Mitsubishi Electric, J

Special Session: High Density Power Adapters

115 **Ideal Flyback Topology**
Ionel Dan Jitaru, Rompower Energy System, USA; Andrei Savu, Bogdan Jitariu, Rompower International, RO; Constantin Radoi, Polytechnic Institute of Bucharest, RO

116 **Study of WBG Switches Benefits on Asymmetrical Half-Bridge Flyback Converter**
Alfredo Medina Garcia, Juan Cruz Cozar, Infineon Technologies, D; Diego Pedro Morales Santos, Noel Rodriguez, University of Granada, ES; Manfred Schlenk, Dr. Schlenk-Consulting, D

117 **Fully Integrated 65W High Density USB-PD Charger**
Alberto Bianco, Claudio Adragna, STMicroelectronics, I

118 **Reduction of Power Loss in a Flyback Transformer by using Optimized Ferrite Core Geometry**
Michael Rottner, TDK Electronics, D

Converter Control

- 119 **AFE: Control Strategies under Unbalanced Grid Conditions**
Lukas Fräger, Mohamed Ibrahim, Sascha Langfermann, Michael Owzareck, BLOCK Transformatoren-Elektronik, D; Jens Friebe, Leibniz University Hannover, D
- 120 **Enhancement of Grid-Synchronization Stability by Means of Disturbance Estimation**
Francisco Freijedo, Roland Hümpfner, Diego López, Huawei Technologies Duesseldorf, D
- 121 **Detailed Dynamic Model of an Active Ripple Reduction Circuit and its Multi-Loop Control Strategy**
Thiago Fonseca Rech, Marcelo Lobo Heldwein, Federal University of Santa Catarina, BR
- 122 **Comparison of Different PWM Methods Assuming Equal Harmonic Loss Conditions**
Ali Sharaf Addin, Thomas Brückner, Universität der Bundeswehr München, D; Benjamin Sahan, Hannover University of Applied Science, D

Electro Magnetic Compatibility and Immunity



- 123 **An Active CM and DM EMI Filter Based on Synthesized and Synchronized Signals for the DC Input of a GaN Inverter**
Andreas Bendicks, Sebastian Windhövel, Michael Gerten, Stephan Frei, Technical University of Dortmund, D
- 124 **Active EMI Suppression with Adapted Cancellation Signals for a Buck Converter in Varying Modes of Operation**
Andreas Bendicks, Tobias Dörlemann, Stephan Frei, Technische Universität Dortmund, D
- 125 **Challenges of Industry 4.0 for the Assessment of Electromagnetic Compatibility (EMC)**
Christof Ziegler, Christian Paulwitz, Stefan Weber, Huber Bachmaier, TDK Electronics, D
- 126 **Prediction and Optimization of Near Magnetic Field Produced by Interconnections of Multi-Cell Converters**
Glauber de Freitas Lima, Jean-Christophe Crebier, Yves Lembeye, Fabien Ndagijimana, G2eLab, F

High Power SiC Devices

- 127 **All SiC Module with 1700V Rated 2nd Generation Trench Gate SiC-MOSFETs**
Alexander Theisen, Fuji Electric Europe, D; Aiko Takasaki, Keiji Okumura, Yoshiyuki Kusunoki, Yasuyuki Kobayashi, Tomojuki Kani, Rikihiko Maruyama, Fuji Electric, J
- 128 **Enhancement of Switching Performance and Output Power Density in 3.3 kV Full SiC Power Module**
Takahiro Morikawa, Seiichi Hayakawa, Kan Yasui, Tatsunori Murata, Koyo Kinoshita, Tetsuo Oda, Katsuaki Saito, Yuji Takayanagi, Hitachi Power Semiconductor Device, J; Toru Masuda, Hitachi Research Laboratory, J
- 129 **3.3kV All SiC MOSFET Module with Schottky Barrier Diode Embedded SiC MOSFET**



Hiroshi Kono, Tomohiro Iguchi, Tatsuya Hirakawa, Hiroyuki Irifune, Takahiro Kawano, Masaru Furukawa, Kenya Sano, Masakazu Yamaguchi, Hisashi Suzuki, Toshiba Electronic Devices & Storage, J; Georges Tchouangue, Toshiba Electronics Europe, D

- 130** **Power Cycling Capability Comparison of SiC-MOSFETs with SBD under Different Conduction Modes**
Yong Zhang, Wei Zhou, Coresing Semiconductor Technology, CHN; Xiaoping Dai, CRRC Zhuzhou Institute, CHN

Power Converters in Transportation Applications

- 131** **Quasi-Isolated HV/HV-DC-DC Converter for Electric Driven Vehicles with Multiple High-Voltage Levels**
Andre Haspel, Urs Boehme, Mercedes-Benz, D
- 132** **Single-Phase Operation of Common-Mode-Free Bidirectional Three-Phase PFC-Rectifier for Non-Isolated EV Charger with Minimized DC-Link**
Benjamin Strothmann, Gerrit Book, Frank Schafmeister, Jochim Böcker, University of Paderborn, D
- 133** **Optimal Sizing on a Mission Profile of Isolated NPC DC-DC Converters using 3.3 kV SiC MOSFETs for Power Electronic Traction Transformers**
Piotr Dworakowski, Caroline Stackler, Florent Morel, Alexis Fouineau, François Wallart, Supergrid Institute, F; Philippe Ladoux, Université de Toulouse, F

System Reliability and Sustainability

- 134** **Health Management of Power Electronics Systems**
Jürgen Schuderer, Chunlei Liu, Antoni Ruiz, Thomas Gloor, Silvan Rehm, Gontran Pâques, Hitachi ABB Power Grids, CH; Antony Hilliard, Sarala Naidu, Hitachi ABB Power Grids, S; Roland Scherwey, University of Applied Sciences and Arts Western, CH
- 135** **Analysis of Passive Power Components Reuse**
Boubakr Rahmani, Jean-Christophe Crebier, Yves Lembeye, G2eLab, F; Maud Rio, Gscop, F
- 136** **A Framework for Reliability Analysis of a SiC Converter for Automotive On-Board Charger Applications**
Nicola Schulz, Paula Diaz Reigosa, Thomas Keller, Tobias Strittmatter, Ishan Pendharkar, University of Applied Sciences Windisch, CH

Power Quality

- 137** **A Highly Integrated 25-Level Cascaded H-Bridge Active Filter for the Mitigation of High Order Current Harmonics**
Daniel Bernet, Rüdiger Schwendemann, Lukas Stefanski, Marc Hiller, Karlsruhe Institute of Technology, D
- 138** **Advantages of SiC MOSFETs in High Frequency Bidirectional PFC Converters for Industrial Applications**
Giuseppe Aiello, Francesco Gennaro, STMicroelectronics, I; Mario Cacciato, University of Catania, I
- 139** **Condition Monitoring of Power Semiconductors by Means of the Controller Output Voltage Harmonics**

Firat Yüce, Marc Hiller, Karlsruhe Institute of Technology, D

SiC / GaN Devices I

- 140** **Experimental Characterization of Different GaN HEMTs used in a Full-Bridge Totem-Pole Power Factor Correction Topology for Electric Vehicles Charging Circuits**
Marco Chiado Caponet, Beuth University of Applied Sciences Berlin, D
- 141** **Switching Loss Estimation of GaN-HEMTs by Thermal Measurement Procedure**
Benedikt Kohlhepp, Daniel Kübrich, Raffael Schwanninger, Thomas Dürbaum, Friedrich-Alexander-University Erlangen-Nuremberg, D
- 142** **GaN based Integrated Power Stages (IPS) for Low Power Adapter/Charger Applications**
Robert Vartanian, Deepak Veeredy, Infineon Technologies, USA;
Alfredo Medina Garcia, Infineon Technologies, D
-  **143** **High-Power Density DC-DC Converters Using Highly-Integrated Half-Bridge GaN ICs**
Michael Basler, Stefan Moench, Richard Reiner, Fouad Benkhelifa, Rüdiger Quay, Oliver Ambacher, Fraunhofer Institute IAF, D; Gerald Weidinger, Gerald Weis, AT&S Austria Technologie & Systemtechnik, A; Ingmar Kallfass, University of Stuttgart, D

SiC in Transportation Application

-  **144** **A SiC Based High Efficiency 22kW Bi-Directional EV On-Board Charger**
Chen Wei, Ying Liu, Haitao Xie, Zongzeng Hu, Wolfspeed, A Cree Company, CHN;
Jianwen Shao, Wolfspeed, A Cree Company, USA
- 145** **Bearing Shield Integrated SiC-Based Traction Inverter for a Dual Three-Phase PMSM Drive System**
Christian Mertens, Julian Berlinecke, Robert Plikat, Volkswagen, D; Jasper Schnack, Jan-Philipp Gördes, Jan Stolley, Ulf Schümann, Ronald Eisele, University of Applied Sciences Kiel, D; Aylin Bicakci, Klaus Olesen, Frank Osterwald, Danfoss Silicon Power, D; Malte Päsler, Anton Gorodnichev, Fraunhofer Institute ISIT, D; Sven Brückner, FTCap|Mersen, D
- 146** **Measures to Improve Efficiency, Peak Power Density and Current Density in an Automotive SiC Drive Train Inverter – Sensitivity Analysis of Design Parameters**
Teresa Bertelshofer, Stefan Hain, ZF Friedrichshafen, D; Cam Pham, Helong Li, CREE Europe, D; Alexander Streibel, Ole Mühlfeld, Danfoss Silicon Power, D
- 147** **Tailoring the Chip Area of SiC MOSFET Power Modules for Traction Applications**
Stefan Schönewolf, Andreas März, Andreas Nagel, Siemens Mobility, D

Control and Drive Strategies

- 148** **Harmonic Impedance Analysis of a Grid-Connected Converter System with Various Control Methods**
Julian Struwe, Pascal Winter, Holger Wrede, José Miguel Cajigal-Núñez, University of Applied Sciences Duesseldorf, D

- 149 **Black Start Capability and Islanded Operation of Power Converters with Virtual Synchronous Generator Control**
Florian Redmann, Alexander Ernst, Bernd Orlik, University of Bremen, D
- 150 **Validation of a Generator-Side Boost Converter with Load by a Fictitious Synchronous Machine**
Alexander Ernst, David Matthies, Wilfried Holzke, Bernd Orlik, University of Bremen, D
- 151 **Small-Signal Model and Control Design Considerations for Three-Phase Dual Active Bridge Converters**
Eduardo Oliveira, Huawei Technologies Duesseldorf, D; Olympio Cipriano da Silva Filho, Federal University of the Semi-Arid Region, BR; Xiao Yu, Peter Zacharias, University of Kassel, D

Thermal Management I

- 152 **Short Thermal Peak Management for Electronic Devices Using Phase Change Materials**
Rabih Khazaka, Stéphane Azzopardi, Aude Cailler Gruet, Safran, F
- 153 **Performance of a Low-Budget, High Precision Calorimetric System for Measuring Power Losses in Power Electronics Components and Circuits**
Finn Tenzer, Felix Bröcker, Norman Landskron, Michael Meissner, Klaus Hoffmann, Helmut Schmidt University, D
- 154 **Additive Manufactured Heatsinks for Power Electronics Assemblies – Multi Physics Topology Optimisation**
Hassan Akhtar, Helen Terry, Phivos Ioannou, Liam Mills, Sandeep Samanthula, Alice Wise, Manufacturing Technology Centre, GB
- 155 **Modeling and Thermal Analysis of Cooling Solutions for High Voltage SMD Packages**
Giuseppe Mauromicale, Domenico Nardo, Alfio Scuto, Giuseppe Sorrentino, Luigi Abbatelli, STMicroelectronics, I; Giacomo Scelba, Giuseppe Scarcella, Arturo Pagano, University of Catania, I

SiC / GaN Devices II

- 156 **Temperature-Dependent Electrical Characteristics of a β -Ga₂O₃ Schottky Barrier Diode**
Florian Wilhelmi, ZF Friedrichshafen, D; Shinji Kunori, Kohei Sasaki, Akito Kuramata, Novel Crystal Technology, J; Yuji Komatsu, ZF Japan, J; Andreas Lindemann, Otto-von-Guericke-University, D
- 157 **Comparison of Fast Switching High Current Power Devices**
Edward Shelton, Kawsar Ali, Renke Han, Daniel Rogers, University of Oxford, GB; Jeff Carter, Lathom Louco, Borg Warner, USA, Borg Warner, GB; Mike Beadman, Cambridge Design Partnership, GB; Patrick Palmer, Simon Fraser University, CDN
- 158 **Identifying Unequal Temperature Distributions in SiC MOSFET Power Modules**
Christoph Lüdecke, Rik W. De Doncker, Michael Laumen, Niklas Fritz, ISEA RWTH Aachen, University, D
- 159 **Directly Cooled Silicon Carbide Power Modules: Thermal Model and Experimental Characterization**

Giuseppe Mauromicale, Alessandra Cascio, Marco Papaserio, Daniela Grazia Cavallaro, Gaetano Bazzano, Angelo Alberto Messina, Michele Calabretta, Alessandro Sitta, STMicroelectronics, I; Salvatore Patanè, University of Messina, I

Thermal Management and Cooling

- 160** **Thermal Management of Power Components and Electric Systems Using Channels Embedded in Metallic Parts by Friction Stir Channeling**
Vito Di Pietro, Joao Gandra, Steve Dodds, TWI, GB
- 161** **Pumped 2-Phase Cooling as an Enabler for Modular, Medium-Voltage, Solid-State Circuit Breaker**
Andrew Slippey, Devin Pellicone, Advanced Cooling Technologies, USA; Andrew Rockhill, Douglas Folts, Andy Schroedermeier, Eaton Research Labs, USA
- 162** **An Inverse Method to Evaluate the Chip Temperature Distribution within Press Pack IGBT**
Jie Chen, Erpin Deng, Yongzhang Huang, North China Electrical Power University, CHN
- 163** **Influence of Internal Semiconductor Processes on Errors at Measurement of Thermal Resistance**
Weinan Chen, Erping Deng, Josef Lutz, Thomas Basler, Technical University of Chemnitz, D

Power Supplies

- 164** **Implementation of Active-Clamped Flyback DC-DC Converter in an 800 V System**
Darko Vracar, Martin Pavlovsky, BRUSA Elektronik, D
- 165** **Full GaN Asymmetrical Half-Bridge PWM Converter with Synchronous Rectifier for a High Efficient 90 W Laptop Charger**
Benedikt Kohlhepp, Valentin Zeller, Thomas Dürbaum, Friedrich-Alexander-University Erlangen-Nuremberg, D
- 166** **High Efficiency, Narrow Output Range and Extended Hold-Up Time Power Supply with Planar and Integrated Magnetics for Server Applications**
Manuel Escudero, Matteo-Alessandro Kutschak, David Meneses, Infineon Technologies, A; Noel Rodriguez, Diego Pedro Morales, University of Granada, E
- 167** **Wide Input Voltage Range Soft Switching Converter for Railway Rolling Stock Auxiliary Power Supply**
Thomas Dias, Philippe Ladoux, Sébastien Sanchez, Laboratoire LAPLACE, F; Tomasz Mielczarski, Philippe Aubin, Faiveley Transport, F

Thermal Management II

- 168** **Improved Natural-Air-Convection-Cooling Formulas for Medium Frequency Transformer Design Optimization**
Jonas Le Roy, Marko Mogorovic, Drazen Dujic, Power Electronics Laboratory, EPFL, CH
- 169** **Experimental Validation of Linear Damage Superposition for IGBT Power Modules under High and Low Temperature Stress Cycles**
Magnar Hernes, Salvatore D'Arco, Ole Christian Spro, Sintef Energy, N; Dimosthenis Peftitsis, Norwegian University of Science and Technology, N

- 170 **Analysis of Surface Mount Heat Sinks for SiC MOSFETs Concerning Heat Dissipation and EMC Behaviour**
Eric Fritze, Lars Zey, Klaus Hoffmann, Kai Rathjen, Stefan Dickmann, Helmut Schmidt University, D; Oliver Woywode, Philips Medical Systems DMC, D
- 171 **Automated Calorimetric Measurement with a Peltier Element for Switching Loss Characterization**
Dominik Koch, Julian Weimer, Ingmar Kallfass, University of Stuttgart, D; Samuel Araujo, Robert Bosch, D

High Power Silicon Devices

- 172 **Innovative Si Increases Output Power of Inverters**
Katsuaki Saito, Hitachi Power Semiconductor Device, J; Tomoyasu Furukawa, Tomoyuki Miyoshi, Mutsuhiro Mori, So Watanabe, Hitachi, J
- 173 **Design Features and Performance Evaluation of the First 6.5kV/1200A Trench Gate IGBT Module**
Luther-King Ngwendson, Arthur Su, Yangang Wang, Imran Siddiqui, Dynex Semiconductor, GB
- 174 **Second Generation BIGT Chip Advancing the StakPak Platform**
Boni Boksteen, Daniel Prindle, Franc Dugal, Wolfgang Amadeus Vitale, Evgeny Tsyplakov, Virgiliu Botan, Gontran Pâques, Hitachi ABB Power Grids, CH
- 175 **10kV RC-IGCT and Fast Recovery Diode: with an Improved Technology Trade-Off Performance**
Umamaheswara Reddy Vemulapati, Thomas Stiasny, Chiara Corvasce, Christian Winter, Tobias Wikström, Hitachi ABB Power Grids, CH; Matthias Lüscher, ABB Switzerland, CH
- 176 **Expanding the Output Power of PrimePACK™ with RC-IGBT in Industrial Applications**
Lukas Kleingrothe, Fuji Electric, D; Yuta Ebukuro, Akio Yamano, VemMitsuhiro Kakefu, Shinichi Yoshiwatari, Yasuyuki Kobayashi, Yuki Oda, Kaname Mitsuzuka, Seiji Momota, Taichi Itoh, Soichi Okita, Fuji Electric, J

Intelligent Gate Drivers

- 177 **Active Gate Control with Synthesized Signals to Avoid Overshoots and Ringing in DC-to-DC Converters**
Andreas Bendicks, Stephan Frei, Caroline Krause, Technical University of Dortmund, D
- 178 **How to Turn off SiC MOSFET with Low Losses and Low EMI Across the Full Operating Range**
Zheming Li, Robert W. Maier, Mark-M. Bakran, University of Bayreuth, D; Daniel Domes, Franz-J. Niedernostheide, Infineon Technologies, D
- 179 **An Adaptive Current Source Gate Driver for SiC MOSFETs with Double Gate Current Injection**
Gard Lyng Rødal, Dimosthenis Pefitsis, Norwegian University of Science and Technology, N
- 180 **Implementation of Current-Source Gate Driver with Open-Loop Slope Shaping for SiC-MOSFETs**

Manuel Riefer, Jonathan Winkler, Sebastian Strache, Robert Bosch, D; Ingmar Kallfass, University of Stuttgart, D

181 Gate-Drive Scheme Reduces Inverter Complexity in Drives Systems using Discrete IGBT in Parallel

Wolfgang Frank, Infineon Technologies, D

Aircraft and Other Transportations Systems

182 Real-Time Monitoring of Harmonic Losses of PMSMs in Electric Drives using a Fourier Decomposition Method

Maximilian Weber, Michele Hirsch, Sebastian Busch, Robert Bosch, D; Hans-Christian Reuss, University of Stuttgart, D

183 Real-Time Data Acquisition for Electrically Powered Commercial Vehicles - Challenges and Solutions

Timo Möller, Lukas Böhning, Ulf Schwalbe, Mathias Herget, University of Applied Sciences Fulda, D

184 Comparison of Modulation Strategies for Common-Mode Distortion Reduction in Aircraft AC Converter Applications

Normann Schwingal, Robin Weiß, Tobias Barth, Steffen Bernet, Technical University of Dresden, D

185 Design of a Photovoltaic Power Supply for Nanosatellites

Tobias Brinker, Jens Friebe, Adrian Gehl, Janosch Graue, Frederik Priefer, Francis Sawang, Bernhard Wicht, Leibniz University Hannover, D

186 Investigation of Novel Multi-Phase Field-Oriented Drive Inverter Control with Fail-Operational Capabilities for Aircraft Applications

Florian Hilpert, Christian Bentheimer, Torsten Müller, Bernd Eckardt, Fraunhofer Institute IISB, D

Renewable Energy and Storage Systems I

187 Two-Stage Probabilistic Short-Term Wind Power Prediction Using Neural Network with MC Dropout and Control Information

Shuichi Sato, Masaki Takanashi, Toyota Central R&D Labs, J; Kentaro Indo, Nozomu Nishihara, Eurus Technical Service, J; Hiroto Ichikawa, Eurus Energy Holdings, J; Hirohisa Watanabe, Toyota Tsusho, J

188 Sensorless Predictive Direct Power Control with On-Line Inductance Estimation for Grid-Connected PV Applications

Mostafa Ahmed, Ibrahim Harbi, Mohamed Abdelrahem, Ralph Kennel, Technical University of Munich, D

189 Predictive Model-based Maximum Power Point Tracking Technique for PV Applications with Reduced Sensor Count

Mostafa Ahmed, Mohamed Abdelrahem, Ibrahim Harbi, Ralph Kennel, Technical University of Munich

190 A 200kW Three-Level Flying Capacitor Inverter Using Si/SiC Based Devices for Photovoltaic Applications

Luis Gabriel Alves Rodrigues, Gaëtan Perez, CEA/INES, F

191 Modular Multilevel Converter for Variable Speed Operation of Pumped Storage Hydropower Plants

Raghbendra Tiwari, Roy Nilsen, Arne Nysveen, Norwegian University of Science and Technology, N

Power Cycling



pcim Europe
Best Paper Award
FINALIST

- 192** **Chip Area Impact on Power Cycling Lifetime of IGBT Modules**
Fabian Nehr, Marion Kind, Marina Montaine, Uwe Scheuermann, SEMIKRON, D



pcim Europe
Young Engineer Award
FINALIST

- 193** **Power Cycling Lifetime Investigation under Low Temperature Swings and 50 Hz Load with Experiment and Simulation**
Christian Schwabe, Nick Thönelt, Peter Seidel, Josef Lutz, Thomas Basler, Technical University of Chemnitz, D



pcim Europe
Young Engineer Award
FINALIST

- 194** **Accelerated Qualification of Highly Reliable Chip Interconnect Technology by Power Cycling Under Thermal Overload**
Carsten Kempiaik, Anton Chupryn, Andreas Lindemann, Otto-von-Guericke-University, D; Alexander Schiffmacher, Jürgen Wilde, Albert-Ludwigs-University Freiburg, D; Jacek Rudzki, Frank Osterwald, Danfoss Silicon Power, D

- 195** **Influence of Power Cycling Aging to IGBT Hard Switching Behavior**
Xing Liu, Erping Deng, Thomas Basler, Christian Bäumlner, Josef Lutz, Qi Huang, Technical University of Chemnitz, D; Jie Chen, North China Electric Power University, CHN

Control Techniques in Electrical Drives

- 196** **Novel Flux-Weakening Strategy Considering the Saturation Effects for Electric Vehicles**
Carlos Miguel-Espinar, Daniel Montesinos-Miracle, Daniel Heredero-Peris, Xavier Escaler, Oriol Subirats-Rillo, UPC, E

- 197** **A Low-Profile GaN-Based Integrated Motor Drive for 48V FOC Applications**
Martin Wattenberg, Edward A. Jones, Juan Sanchez, Infineon Technologies, A

- 198** **High-Performance Control Architecture for Automation Drives based on a Low-Cost Microcontroller in Combination with a Low-Cost FPGA**
Tobias Schmidt, Jens Onno Krahl, University of Applied Sciences Cologne, D; Joachim Holtz, University of Wuppertal, D

- 199** **Lean Safe Drive Architecture with Fully Integrated Multi-Axis Safety Functions due to an Extremely Fast Safety-related Fieldbus Interface**
Jens Onno Krahl, Malte Katz, Tobias Schmidt, University of Applied Sciences Cologne, D; Ben Jeppesen, Intel, GB

Special Session: Additive Manufacturing and Printed Electronics

- 200** **Printing Beyond Color - The Potential of Printed Electronics Circuitry for Industrial Applications**
Reinhard Baumann, Technical University of Chemnitz, D; Ralf Zichner, Fraunhofer Institute ENAS, D

- 201 **Current Applications and Outlook of AME Additively Manufactured Electronics aka. 3D printed Electronics**
Valentin Storz, Nano Dimension, IL
- 202 **Scalable 3D Printed Electronics – “Fully Additive To High Volume Manufacture**
Martin Hedges, Neotech AMT, D
- 203 **Disruptive Approach of Additive Manufactured Electronics (AME)**
Michael Schleicher, Matthias Kujath, SEMIKRON, D; Valentin Storz,
Nano Dimension, IL

Renewable Energy and Storage Systems II

- 204 **A Novel Adaptive Square-Root Unscented Kalman Filter for Battery SoC Estimation**
Davide Fusco, Mauro Di Monaco, Francesco Porpora, Giuseppe Tomasso,
University of Cassino and Southern Lazio, I
- 205 **Methods for Voltage Equalization of Energy Storage Systems**
Dimitar Arnaudov, Krasimir Kishkin, Vladimir Dimitrov, Teodora Todorova,
Technical University of Sofia, BG
- 206 **Developing an Advanced Equivalent Circuit Model for a Li-Ion Battery for Battery Monitoring in Electric Vehicles**
Mussab Najeeb, Technical University of Ilmenau, D; Ulf Schwalbe, University of Applied Sciences Fulda, D
- 207 **Energy Storage Capabilities of Supercapacitors in a High Power Application**
Frank Puhane, Rene Kalbitz, Würth Elektronik eiSos, D

Design Tools I

- 208 **A New Analog Behavioral SPICE Macro Model with Self-Heating Effects for Gallium Nitride HEMTs**
Gaetano Verona, Alessandra Raffa, Pier Paolo Veneziano, Carlo Brugaletta,
Gaetano Bazzano, STMicroelectronics, I
- 209 **How to Choose the Optimal GaN-HEMT for a Hard Switching Application - A Guide**
Julian Dobusch, Raffael Schwanninger, Benedikt Kohlhepp, Thomas Dürbaum,
Friedrich-Alexander-University Erlangen-Nuremberg, D
- 210 **Design Guidelines for the Optimization of High Frequency PCB Transformers**
Lucía Clavero Ordóñez, Miroљub Bakic, Thiwanka Wijekoon, Huawei Technologies
Nuremberg Research Center, D; Alberto Delgado Expósito, Pedro Alou Cervera,
Technical University of Madrid, E;
- 211 **Efficiency and Power Density Optimization of Three-Level TP PFC**
Enis Baris Bulut, University of Trakya, TR; Mehmet Onur Gulbahce, Fatih Sultan
Mehmet Vakif University, TR; Derya Ahmet Kocabas, Istanbul Technical
University, TR; Serkan Dusmez, Arçelik, TR

AC-DC and DC-AC Conversion I

- 212** **Highly Efficient SiC-Based Active Infeed Converter for Industrial DC Conductor Systems**
Jan-Niklas Koch, Raphael Otte, Holger Borcharding, Technical University of Ostwestfalen-Lippe, D
- 213** **Inverter Design Study for a Battery Cooling Compressor for 800V Electric Vehicles with Focus on Efficiency and Inverter Volume**
Max Kolletzki, Marco Denk, Dominik Anderson, Brose Fahrzeugteile D; Lukas Reißenweber, Alexander Stadler, University of Applied Sciences and Arts Coburg, D
- 214** **Design and Optimization of Simultaneous Wireless Power Transfer and Near Field Communication Systems**
Christian Merz, Daniel Gückelhorn, Cem Som, Würth Elektronik eiSos, D
- 215** **Efficiency-Oriented Design of Litz Wire for Several kW Power Experimented on 20kW Prototype**
Damien Lemaitre, Benoit Sarrazin, Yves Lembeye, Alexis Derbey, G2elab, F; Yohan Wanderoild, EDF, F

Advanced Si Devices I

- 216** **Influence of Passive IGBT Control Scheme on Diode Recovery Behavior in Device Characterization Measurements**
Uwe Schilling, Jürgen Engstler, Peter Beckedahl, SEMIKRON Elektronik, D
- 217** **Rugged LV Trench IGBT with Extreme Stability in Continuous SOA Operation: Next Generation LV Technology at Hitachi ABB Powergrids**
Elizabeth Buitrago, Nick Schneider, Wolfgang Vitale, Gaurav Gupta, Luca DeMichielis, Hitachi ABB Power Grids, CH
- 218** **Higher Output Performance Despite Chip Shrinkage: New FF600R12ME7_B11 Outperforms Former Generation**
Jan Baurichter, Klaus Vogel, Andreas Schmal, Oliver Lenze, Philipp Ross, Elena Aksel, Infineon Technologies, D
- 219** **Retrofit of a Superstar: New EconoDUAL™ 3 Black Series combines new Features with Well-Known Advantages**
Klaus Vogel, Jan Baurichter, Vitali Weiss, Christian Steininger, Fabian Severin, Infineon Technologies, D

Gate Drivers and Sensing I

- 220** **Development of a Powerful Gate-Driver-Circuit for High-Frequency Control of a DC-DC-Converter Based on Gallium Nitride Transistors**
Raphael Löffler, Jan Hückelheim, Dominik Koch, Ingmar Kallfass, University of Stuttgart, D
- 221** **Transmission Line Approach for the PCB Gate Interconnection Design in GaN-Based High-Frequency Power Converters**
Alonso Gutierrez Galeano, Emmanuel Marcault, CEA, F; Corinne Alonso, David Tremouilles, LAAS-CNRS, F
- 222** **Automated PCB Parasitics Extraction from EDA Tools for Power Electronics Design Support**
Sven Fießler, Technical University of Ilmenau, D; Ulf Schwalbe, University of Applied Sciences Fulda, D

- 223 Indirect Multiple DC Link Current Sensing Using Op-Amp Circuits in a Three-Phase Three-Level PWM Inverter**
Arturs Bogdanovs, Oskars Krievs, Riga Technical University, LV; Johannes Pforr, University of Applied Sciences Ingolstadt, D

Design Tools II

- 224 A Design Method of an Embedded Real-Time Simulator for Electric Drives using Low-Cost System-on-Chip Platform**
Aravinda Perera, Roy Nilsen, Thomas Haugan, Norwegian University of Science and Technology, N; Kjell Ljøkelsøy, SINTEF Energy Research, N
- 225 Modular Power Electronics Platform for Evaluation and Rapid Prototyping Using an NPC Converter**
Folkhart Grieger, Kostiantyn Koïro, Philipp Jungklass, Andreas von Daake, Nils Falke, IAV, D
- 226 How a Hybrid Power Amplifier Using Power Hardware-in-the-Loop Technologies Can Perform Studies on Highly Resonant Grid Phenomena**
Jonas Steffen, Ron Brandl, Fan Wang, Fabian Schnabel, Anton Gorodnichev, Jörg Kirchhof, Matthias Klee, Axel Seibel, Marco Jung, Fraunhofer Institute IEE, D; Michael Schmidhuber, SUMIDA Components & Modules, D
- 227 High Power Converter 100 W Buck-Boost in Detail – Selection of the Capacitors**
Frank Puhane, Andreas Nadler, Würth Elektronik eiSos, D

AC-DC and DC-AC Conversion II

- 228 Double Side Cooled Modules Enable Future Generation of SiC-Traction-Inverters**
Peter Weiss, Christoph Bauer, Robert Jung, Katharina Berberich, AVL Software and Functions, D
- 229 Efficiency Comparison of Three-Phase Four-Wire Inverter Topologies for Unbalanced and Nonlinear Loads**
Daniel Stracke, Marco Jung, Fabian Schnabel, Sebastian Sprunck, Fraunhofer Institute IEE, D
- 230 Optimized Design Method and Control of an Auxiliary Resonant Commutated Pole Inverter for Two Level Photovoltaic Inverters**
Gholamreza Tabrizi, Fabian Schnabel, Marco Jung, Fraunhofer Institute IEE, D
- 231 Design of an Intelligent, Modular IGBT/SiC Inverter Platform up to 400 kW for Fast Realization of New Test-Bench Concepts**
Johannes Stoß, Simon Frank, Nikolas Menger, Fabian Sommer, Marco Gast, Simon Decker, Andreas Liske, Marc Hiller, Karlsruhe Institute of Technology, D

Advanced Si Devices II

- 232 Nexperia Innovative Current Sharing Technology in Parallel MOSFETs Applications**
Stein Hans Nesbakk, Nexperia UK, GB

- 233** **Super SOA Power MOSFETs Solution in HOT-Swap Application**
Sami Ould-Ahmed, Mark Gajda, Nexperia UK, GB
- 234** **Benchmarking and Efficiency Analysis of State-Of-The-Art 200 V Diode Technologies Under Fast Switching Conditions**
Ali Aneissi, Michael Meissner, Klaus Hoffmann, Helmut Schmidt University, D;
Reza Behtash, Jan Fischer, Sebastian Fahlbusch, Nexperia, D
- 235** **New Generation High Power Density 3300V RC-IGBT Power Module**
Guozhong Dong, Yongdian Peng, Haihui Luo, Guiqing Chang, State Key Laboratory of Advanced Power Semiconductor Devices, CHN;
Lihen Zhu, Tao Yuan, Yibo Wu, Menyan Wang, CRRRC Times Semiconductor, CHN

Gate Drivers and Sensing II

- 236** **Thermal Impedance Measurement Utilizing Optical Measurement and Thermal Impedance Model for Multichip SiC MOSFET Module with Anti-Parallel Diodes**
Min-Ki Kim, Sang Won Yoon, Hanyang University, ROK
- 237** **L860: An NTC Thermistor Chip Suitable for Temperature Control in Power Modules**
Thomas Taubert, TDK Sensors, D; Thomas Bernert, Jan Ihle, Lutz Heiner Kirsten, TDK Electronics, A; Peter Supancic, University of Leoben, A
- 238** **Mirror Source based Overcurrent and Short Circuit Protection Method for High Power SiC MOSFETs**
Fabian Sommer, Fabian Stamer, Nikolas Menger, Marc Hiller, Karlsruhe Institute of Technology, D; Nils Soltau, Shiori Idaka, Mitsubishi Electric Europe, D
- 239** **Investigation of Output Stage in Gate Driver ICs**
Emanuel-Petre Eni, Wolfgang Frank, Haitham Elsayed, Infineon Technologies, D

Automotive Applications I

- 240** **AirSiC – A Silicon-Carbide Based Air-Cooled Traction Inverter is the Enabler for a Simplified, Distributed Powertrain System in a Passenger Vehicle**
Christian Schweikert, Infineon Technologies, D; Jan Zachariae, VW, D; Tim-Andy Benning, AVL Software and Functions, D; Randeep Singh, Fujikura, D
- 241** **Junction Temperature Estimation for a High Power SiC Traction Inverter**
Laura Siplika, Bernd Plassnegger, Markus Koller, AIT Austrian Institute of Technology, A
- 242** **Comparison Between Copper-Aluminium Laser Joining using Short Pulses and Continuous Wave Mode**
Elie Haddad, Johanna Helm, Alexander Olowinsky, Fraunhofer Institute ILT, D; Ole Katz, RWTH Aachen University, D
- 243** **Control of a Three Level Three Phase 20 kW Power Factor Correction (PFC) for Charging Applications**
Akshay Mahajan, Christoph Siedle, Stefan Reichert, Fraunhofer Institute ISE, D

Power Quality and EMC I

- 244** **Reduction of Harmonic Currents with a Very Low-Cost Power Factor Corrector Stage in Three Phase Power Supply Systems**
Marco Chiado Caponet, Beuth University of Applied Sciences Berlin, D
- 245** **A Differential Mode Noise Estimation and Filter Size Comparison in Totem-Pole PFC Converters**
Ali Tausif, Technical University of Yildiz, TR; Serkan Dusmez, Arçelik, TR
- 246** **Voltage Controlled Shunt Active Power Filter with Grid Impedance Estimation**
Swen Bosch, Jochen Staiger, Heinrich Steinhart, University of Applied Sciences Aalen, D
- 247** **Investigation of the Suitability of an Electrical Machine Emulation for EMC Component Tests of Drive Inverters**
Michaela Gruber, Manuel Fischer, Michael Beltle, Stefan Tenbohlen, University of Stuttgart, D

Digital Control I

- 248** **Flatness based Control of DC-DC Converters with Constant Power Loads**
Michael Zauner, Philipp Mandl, Christoph Hametner, Stefan Jakubek, Technical University of Vienna, A; Oliver König, AVL LIST, A
- 249** **Comparison of Control Algorithms for the Suppression of Current Harmonics in PMSMs**
Annette Mai, Bernhard Wagner, Nuremberg Institute of Technology Georg Simon Ohm, D; Stefan Arenz, Fraunhofer Institute IISB, D
- 250** **Adaptive Reference Current Waveform Adjustment for the Torque Control of Transverse Flux Machines**
Sören Behrens, Holger Groke, Bernd Orlik, University of Bremen, D
- 251** **Finite Element Analysis of a PMSM for Position Sensorless Control with the INFORM Method**
Richard Spießberger, Andreas Brunner, Manfred Schrödl, Technical University of Vienna, A

Inductors and Transformers I

- 252** **Low-Power High-Frequency PCB Transformer Design with Medium-Voltage Isolation**
Ole Christian Spro, Frank Mauseth, Dimosthenis Pefitsis, Norwegian University of Science and Technology, N
- 253** **Simple Steady-State Loss Measurement of Toroidal Cores at High Switching Frequencies**
Sascha Langfermann, Lukas Fräger, Michael Owzareck, BLOCK Transformatoren-Elektronik, D; Urs Obernolte, Lenze, D
- 254** **Calculation Method for Four-Legged Inductors of Sine-Wave Filters in Drive Systems**
Michael Owzareck, Sören Fröhling, Sascha Langfermann, Lukas Fräger, BLOCK Transformatoren-Elektronik, D; Nejila Parspour, University of Stuttgart, D

- 255** **Calculation and Verification of High-Frequency Losses in Power Inductors for Automotive Application**
Christoph Drexler, Manfred Wohlstreicher, Philemon Wrensch, Herbert Jungwirth, Michael Schmidhuber, SUMIDA Components & Modules, D

Automotive Applications II

- 256** **Automotive Traction Inverter using 4th Generation SiC MOSFET Power Module**
Kotaro Shibata, Atsushi Yamaguchi, Hirokatsu Umegami, Masashi Hayashiguchi, Noriaki Kawamoto, Akihiro Hikasa, ROHM, J
- 257** **Simulation and Control of a New Integrated Battery System for Automotive Applications**
Clément Mayet, Denis Labrousse, Adrien Dittrick, Bertrand Revol, Rihab Bkekri, SATIE, F; Francis Roy, STELLANTIS, F
- 258** **An Advanced Adjustable Switch Hybrid (ASH) Concept for High Power Automotive Converters**
Munaf Rahimo, MTAL, CH; Renato A. Minamisawa, Silvia Mastellone, Tanya Koottungal, Joachim Spoendlin, University of Applied Sciences Northwestern, CH; Iulian Nistor, mqSemi, CH; Thiago Batista, Soeiro Delft University of Technology, N
- 259** **Isolated Single – Stage Interleave Resonant Converter for EV Charger with Passive Output Ripple Cancellation Circuit**
Abidemi Eleyele, University of Uppsala, S; Grover Torrico-Bascopé, Huawei Technologies, S

Power Quality and EMC II

- 260** **Characterization of a New Hybrid Thermal Conductive and EMI Absorber Material**
Antonio Alcarria, Jorge Victoria, Sebastian Mirasol, Würth Elektronik eiSos, D; Adrian Suarez, Pedro Martínez, Julio Martos, Jesus Soret, Raimundo Olcina, Jose Torres, University of Valencia, E
- 261** **Superiority of Full SiC Interleaved PFC Module in Radiated Noise Comparison with Hybrid SiC Module**
Shin Suzuki, Toshiya Tadakuma, Motonobu Joko, Mitsubishi Electric, J
- 262** **Influence of MOSFET Scattering on Common Mode Cancellation in Phase Shifted Inverter Operation**
Jonas Bertelmann, Michael Beltle, Stefan Tenbohlen, University of Stuttgart, D
- 263** **Semi-Analytical Model of Parasitic Capacitance of Inductor with Conductive Core**
Florentin Salomez, Arnaud Videt, Nadir Idir, University of Lille, F

Digital Control II

- 264** **Comparison of Pole Restraining and Cascaded Control Shown on a Three-Phase-Three-Level PFC Application**
Marcel Gladen, WIL0, D; Volker Staudt, Ruhr-University Bochum, D
- 265** **Position Sensorless Control of a Ferrite Magnet Assisted Synchronous Reluctance Machine in the Whole Speed Range**

Mario Nikowitz, Matthias Hofer, Manfred Schrödl, Technical University of Vienna, A

266 Weighting Factorless Reduced-Complexity FCS-MPC for Modified Packed U-cell Inverter Topology

Ibrahim Harbi, Mohamed Abdelrahem, Mostafa Ahmed, Ralph Kennel, Technical University of Munich, D

Inductors and Transformers II

267 Analysis of Approaches for Reduction of the Parasitic Capacitances in Transformers with Copper Foil Windings for Fast Switching Applications

Christian Bödeker, Michael Meissner, Klaus Hoffmann, Helmut Schmidt University, D; Christian Dietmann, Tobias Appel, Daniel Benner, STS - Spezial-Transformatoren Stockach, D

268 Novel Measurements Characterizing a Ferrite in Deep Saturation

Jeremias Kaiser, Andreas Bammes, Thomas Dürbaum, Friedrich-Alexander-University Erlangen-Nuremberg, D

269 Design of PCB-Mounted Power Chokes for Simple Integration and Direct Heatsink Assembly

Lukas Fräger, Sascha Langfermann, Michael Owzareck, Dieter Hestermann, Dennis Kampen, BLOCK Transformatoren-Elektronik, D