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**Robert Pilawa-Podgurski**, *University of California, Berkeley*

**Yeonho Jeong**, *University of Rhode Island*

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TRACK Modeling and Simulation

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**Sombuddha Chakraborty**, *Texas Instruments*

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TRACK AC-DC Converters

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**John Lam**, *York University*

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TRACK DC-DC Converters

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**Cahit Gezgin**, *Infineon*

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TRACK Devices and Components

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<sup>1</sup>*University of Arkansas, United States;* <sup>2</sup>*University of Nottingham, United Kingdom*

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*<sup>1</sup>University of Dayton, United States; <sup>2</sup>Navitas Semiconductor, United States; <sup>3</sup>North Dakota State University, United States*

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TRACK Devices and Components

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TRACK Power Electronics Integration and Manufacturing

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TRACK Modeling and Simulation

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**Shajjad Chowdhury**, *Oak Ridge National Laboratory*

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TRACK Control

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**Jaber Abu Qahouq**, *The University of Alabama*  
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## D09: Control 2

TRACK Control

SESSION CHAIR

**Emanuel Serban**, *The University of British Columbia*

- D09.1 I-f Starting Rapid and Smooth Transition Method of Full-Speed Sensorless Control for Low Current Harmonic Ultra-High-Speed PMSM** ..... 1820  
Yao Xu, Cheng Lin, Jilei Xing, Qingtan Zeng, Jianxia Sun  
*Beijing Institute of Technology, China*
- D09.2 PID Controller Tuning of Voltage Mode Controlled Buck Converter for Fast Recovery Up to Slew Limit** ..... 1827  
Santanu Kapat  
*Indian Institute of Technology Kharagpur, India*
- D09.3 Novel Power Decoupling Methods for Three-Port Triple-Active-Bridge Converters** ..... 1833  
Hui Cao<sup>1</sup>, Guangqi Zhu<sup>2</sup>, Fei Diao<sup>1</sup>, Yue Zhao<sup>1</sup>  
<sup>1</sup>*University of Arkansas, United States;* <sup>2</sup>*Eaton, United States*
- D09.4 Gate Drive Circuit with In Situ Condition Monitoring System for Detecting Gate Oxide Degradation of SiC MOSFETs** ..... 1838  
Shin-Ichiro Hayashi, Keiji Wada  
*Tokyo Metropolitan University, Japan*
- D09.5 High-Frequency Digital Current Mode Control Architectures for Class-D Audio Amplifiers** ..... 1846  
Pratik Singh, K. Hariharan, Santanu Kapat  
*Indian Institute of Technology Kharagpur, India*
- D09.6 Push-Pull Current-Fed DC-DC Converter Start-Up Operation** ..... 1853  
Alexey Bodrov<sup>1</sup>, James E. Green<sup>1</sup>, Pavankumar Puligundla<sup>1</sup>, Mathews Tomy<sup>2</sup>, Sarath Mohanan Pillai<sup>2</sup>  
<sup>1</sup>*Zhuzhou CRRC Times Electric Co. Ltd., United Kingdom;* <sup>2</sup>*TATA Elxsi, United Kingdom*
- D09.7 Decentralized Interleaving of Cascaded H-Bridge Multi-Level Converters** ..... 1859  
Oscar Andrés Montes, M.A. Awal, Wensong Yu, Iqbal Husain, Srdjan Lukic  
*North Carolina State University, United States*

## D10: Wireless Power Transfer Systems

TRACK Wireless Power Transfer

SESSION CHAIRS

**Joseph Song-Manguelle**, *Oak Ridge National Laboratory*

**Shajjad Chowdhury**, *Oak Ridge National Laboratory*

- D10.1 Non-Isolated Buck-Boost Hybrid Converter with AC-AC/DC Power Conversion for Simultaneous Wired and Wireless Power Transfer** ..... 1863  
Jiayang Wu<sup>1</sup>, Albert T.L. Lee<sup>1</sup>, Siew-Chong Tan<sup>1</sup>, S.Y. Ron Hui<sup>2</sup>  
<sup>1</sup>*University of Hong Kong, China;* <sup>2</sup>*Nanyang Technological University, Singapore*
- D10.5 A Novel Power Combining Strategy for Rectenna Array of Microwave Power Transmission System** ..... 1870  
Zehao Zhai, Ke Jin, Weiyang Zhou, Xue Wang  
*Nanjing University of Aeronautics and Astronautics, China*
- D10.6 Simultaneous Wireless Power and Data Transmission for Laser Power Transfer System Based on Frequency-Shift Keying Modulation Method** ..... 1874  
Han Zhang, Ke Jin, Weiyang Zhou  
*Nanjing University of Aeronautics and Astronautics, China*



<b>D10.7</b>	<b>Design of Multi-Receiver IPT System for Electric Vehicles considering Transfer Efficiency and Different Power Requirements</b> .....	1878
	Zhi Feng, Junjun Deng, Lantian Li, Baokun Zhang, Zhenpo Wang <i>Beijing Institute of Technology, China</i>	
<b>D10.8</b>	<b>Modeling and Analysis of a Polyphase Wireless Power Transfer System for EV Charging Applications</b> .....	1885
	Rong Zeng, Omer C. Onar, Mostak Mohammad, Gui-Jia Su, Erdem Asa, Veda P. Galigekere <i>Oak Ridge National Laboratory, United States</i>	
<b>D10.9</b>	<b>Frequency Domain Analysis of a Wireless Power Transfer System Operating in a Wide Load and Coupling Range Using Frequency Modulation of Inverter for Voltage Regulation</b> .....	1891
	Arpan Laha, Abirami Kalathy, Praveen Jain <i>Queen's University, Canada</i>	

## **D11: Renewable Energy Systems**

TRACK Renewable Energy Systems

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**Luocheng Wang**, *EnerSys*

**Rajeev Singh**, *Indian Institute of Technology (BHU) Varanasi*

<b>D11.1</b>	<b>Battery Equalizer for Series-Connected Batteries Based on Half-Bridge LLC Topology</b> ..	1898
	Xinyu Sun, Chunjian Cai, Jianglin Nie, Yuhao Deng, Zeliang Shu <i>Southwest Jiaotong University, China</i>	
<b>D11.2</b>	<b>Flexible Provision of Ancillary Services by Grid-Tied Inverters</b> .....	1904
	Anastasis Charalambous, Lenos Hadjidemetriou, Marios Polycarpou <i>University of Cyprus, Cyprus</i>	
<b>D11.3</b>	<b>Provision of Phase Balancing and Reactive Power Compensation with Junction Temperature Control by Photovoltaic Inverters</b> .....	1912
	Anastasis Charalambous, Lenos Hadjidemetriou, Marios Polycarpou <i>University of Cyprus, Cyprus</i>	
<b>D11.4</b>	<b>A Reactive Power Distribution Method for the Reactive Power Control of Cascaded Photovoltaic Converter under Active Power Imbalance Condition</b> .....	1920
	Gongheng Li, Min Chen, Yufei Jie, Chu Wang <i>Zhejiang University, China</i>	
<b>D11.5</b>	<b>Data-Driven Cyber-Attack Detection for Photovoltaic Systems: A Transfer Learning Approach</b> .....	1926
	Qi Li, Jinan Zhang, Jin Ye, Wenzhan Song <i>University of Georgia, United States</i>	
<b>D11.6</b>	<b>A Droop Control Algorithm with Frequency Partitioning Capability and SoC Balancing for Different Energy Storage Systems</b> .....	1931
	Nilooofar Ghanbari, Subhashish Bhattacharya <i>North Carolina State University, United States</i>	
<b>D11.7</b>	<b>Cyber-Attack Detection for Active Neutral Point Clamped (ANPC) Photovoltaic (PV) Converter Using Kalman Filter</b> .....	1939
	Jinan Zhang, Jin Ye <i>University of Georgia, United States</i>	

- D11.8 Power Processing Reduction in Energy Storage Systems by Using a Fractional Power Converter with Bipolar Output Voltage** ..... 1945  
Yiqiang Huang, Hong Guo, Zhenyu Shan  
*Beihang University, China*
- D11.9 Negative Virtual Inductance Based Active Damping and Direct Power Control of a Soft Switching Solid State Transformer for PV Application** ..... 1950  
Vikram Roy Chowdhury, Rajendra Prasad Kandula, Deepak Divan  
*Georgia Institute of Technology, United States*
- D11.10 Farm-Level Interactions Study of a Novel Tri-Port Soft-Switching Medium-Voltage String Inverter (MVSI) Based Large-Scale PV-Plus-Storage Farms** ..... 1956  
Vikram Roy Chowdhury, Zheng An, Rajendra Prasad Kandula, Deepak Divan  
*Georgia Institute of Technology, United States*
- D11.11 Resilient Operation of Hybrid AC/DC Microgrid with Interlinking Converter Based on Modular Multilevel Converter with Integrated BESS** ..... 1963  
Jean M.L. Fonseca, Ravi Prakash Reddy, Kaushik Rajashekara  
*University of Houston, United States*
- D11.12 DQ Impedance-Based Analysis of an APF-Type Active Damper to Stabilize the Grid-Tied Inverter System** ..... 1971  
Yiming Tu, Wei Chen, Jinjun Liu  
*Xi'an Jiaotong University, China*
- D11.13 Hardware Design of a 150kW/1500V All-SiC Grid-Forming Photovoltaic Synchronous Generator (PVSG)** ..... 1977  
Zibo Chen, Houshang Salimian Rizi, Wei Xu, Ruiyang Yu, Alex Q. Huang  
*University of Texas at Austin, United States*

## **D12: Transportation Power Conversion 3**

TRACK Transportation Power Electronics

SESSION CHAIRS

**Rasoul Hosseini**, *General Motors*

**Woongkul Lee**, *Michigan State University*

- D12.1 A Non-Cascading Step-Up/Down DC-DC Converter with Non-Pulsating Input Current for Lithium-Ion Battery Applications: Analysis and Design** ..... 1985  
Jesus Leyva-Ramos<sup>1</sup>, Juan Antonio Villanueva-Loredo<sup>1</sup>, Ma Guadalupe Ortiz-Lopez<sup>2</sup>, Luis Humberto Diaz-Saldierna<sup>1</sup>  
<sup>1</sup>*Instituto Potosino de Investigación Científica y Tecnológica, A.C., Mexico;*  
<sup>2</sup>*Universidad Politécnica de San Luis Potosí, Mexico*
- D12.2 Variables Decoupling and Multi-Objective Optimization for High-Power Bidirectional Interleaved Converters in Electric Vehicles** ..... 1993  
Xiaoyong Ma, Ping Wang, Yifeng Wang, Long Tao, Pengyu Cheng, Danfeng Zhao  
*Tianjin University, China*
- D12.4 Isolated Three-Port Bidirectional DC-DC Converter for Electric Vehicle Applications** ..... 2000  
Misha Kumar<sup>1</sup>, Peter M. Barbosa<sup>1</sup>, Juan M. Ruiz<sup>2</sup>, Jia Minli<sup>2</sup>, Sun Hao<sup>2</sup>  
<sup>1</sup>*Delta Electronics Americas Ltd., United States;* <sup>2</sup>*Delta Electronics Shanghai Co. Ltd., China*
- D12.5 Three-Loop Multi-Variable Control of Triple Active Bridge Converter with Power Flow Optimization** ..... 2008  
Ashwin Chandwani, Ayan Mallik  
*Arizona State University, United States*

- D12.6 Performance Comparison and Modelling of Instantaneous Current Sharing amongst GaN HEMT Switch Configurations for Current Source Inverters** ..... 2014  
 Mustafeez Ul Hassan<sup>1</sup>, Asif Imran Emon<sup>1</sup>, Zhao Yuan<sup>2</sup>, Hongwu Peng<sup>3</sup>, Fang Luo<sup>1</sup>  
<sup>1</sup>*Stony Brook University, United States*; <sup>2</sup>*University of Arkansas, United States*;  
<sup>3</sup>*University of Connecticut, United States*

- D12.7 Isolated 4-Level DC-DC Converter with Enhanced Soft-Switching Adaptability and Output Voltage Flexibility for High-Power Charger Applications** ..... 2021  
 Dakai Wang<sup>1</sup>, Wensong Yu<sup>1</sup>, Greg Mann<sup>2</sup>, Dennis Meyer<sup>2</sup>, Ehab Tarmoom<sup>2</sup>,  
 Steven Chenetz<sup>2</sup>, Xuning Zhang<sup>2</sup>, Kevin Speer<sup>2</sup>  
<sup>1</sup>*North Carolina State University, United States*; <sup>2</sup>*Microchip Technology Inc., United States*

### D13: Power Applications

TRACK Power Electronics Applications

SESSION CHAIRS

**Khorshed Alam**, *General Motors*

**Jeffery Nilles**, *Alpha & Omega Semiconductor*

- D13.1 A Non-Isolated Dual-Output High-Step-Down Converter** ..... 2029  
 Y.T. Yau  
*National Chin-Yi University of Technology, Taiwan*

- D13.2 Temperature Dependent Characterization-Based Design Optimization of a DC-DC Converter for High-Temperature Applications** ..... 2034  
 Saikat Dey<sup>1</sup>, Ayan Mallik<sup>1</sup>, Neil Goldsman<sup>2</sup>, Zeynep Dilli<sup>2</sup>  
<sup>1</sup>*Arizona State University, United States*; <sup>2</sup>*CoolCAD Electronics, LLC, United States*

- D13.4 Dc Fault Detection of Shipboard Pulsed Power Loads Using Logistic Regression** ..... 2040  
 Lalithsai Posam, Yue Ma, Keith Corzine  
*University of California, Santa Cruz, United States*

### D14: DC-DC Converters 1

TRACK DC-DC Converters

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**Cahit Gezgin**, *Infineon*

- D14.1 Hybrid Switched-Capacitor LLC Converter with Ultra Wide Input Voltage Range and High Efficiency** ..... 2044  
 Rudy Rice, Peng Fang  
*University of Minnesota Duluth, United States*

- D14.2 Exact-Order Discrete-Time Modeling of a DAB Derived Hybrid Switched-Capacitor Converter** ..... 2051  
 Somnath Khatua, Debaprasad Kastha, Santanu Kapat  
*Indian Institute of Technology Kharagpur, India*

- D14.3 Design and Experimental Study of a High Voltage Gain Bidirectional DC-DC Converter for Electrical Vehicle Application** ..... 2058  
 Reza Rezaii<sup>1</sup>, Mohammad Nilian<sup>2</sup>, Md Safayatullah<sup>1</sup>, Fahad Alaq<sup>1</sup>, Issa Batarseh<sup>1</sup>  
<sup>1</sup>*University of Central Florida, United States*; <sup>2</sup>*Tarbiat Modares University, Iran*

- D14.4 Multiphase 3-Level Buck Passives Analysis including 2-Phase Coupled Inductors** ..... 2064  
 Youssef Kandeel<sup>1</sup>, Séamus O'Driscoll<sup>2</sup>, Cian Ó Mathúna<sup>2</sup>, Maeve Duffy<sup>1</sup>  
<sup>1</sup>*National University of Ireland Galway, Ireland*; <sup>2</sup>*University College Cork, Ireland*

<b>D14.5</b>	<b>Charge Sharing LAU Switched-Capacitor Converter with Reducing Power Loss</b> .....	2070
	Jaesoon Choi <sup>1</sup> , Kin Keung Lau <sup>2</sup> , Seokmun Choi <sup>1</sup> , Inkuk Baek <sup>1</sup> <i><sup>1</sup>Silicon Mitus Inc., Korea; <sup>2</sup>Empower Semiconductor, United States</i>	
<b>D14.6</b>	<b>Deep-Learning-Based Steady-State Modeling and Model Predictive Control for CLLC DC-DC Resonant Converter in DC Distribution System</b> .....	2075
	Kefan Yu, Fang Zhuo, Feng Wang, Xinyu Jiang <i>Xi'an Jiaotong University, China</i>	
<b>D14.7</b>	<b>Fast Transient State Feedback Digital Current Mode Control Design in Series Capacitor Buck Converters</b> .....	2080
	Prantik Majumder, Santanu Kapat, Debaprasad Kastha <i>Indian Institute of Technology Kharagpur, India</i>	
<b>D14.8</b>	<b>A Modular Single-Stage PV Step-Up Converter with Integrated Power Balancing Feature Using Inter-Coupled Active Voltage Quadruplers</b> .....	2086
	Kajanan Kanathipan, John Lam <i>York University, Canada</i>	
<b>D14.9</b>	<b>A Novel Five-Level Hybrid Dual Active Bridge Converter with Optimized Switching Principle</b> .....	2092
	Gautam Ratanpuri, Satish Belkhode, Anshuman Shukla <i>Indian Institute of Technology Bombay, India</i>	

## **D15: DC-DC Converters 2**

TRACK DC-DC Converters

SESSION CHAIR

**Olivier Trescases**, *University of Toronto*

<b>D15.2</b>	<b>High-Frequency LLC Converter with Narrow Frequency Variations for Aircraft Applications</b> .....	2098
	Aurora de Juan <sup>1</sup> , Diego Serrano <sup>1</sup> , Pedro Alou <sup>1</sup> , Jean-Nöel Mamousse <sup>2</sup> , Romain Deniéport <sup>2</sup> , Miroslav Vasic <sup>1</sup> <i><sup>1</sup>Universidad Politécnica de Madrid, Spain; <sup>2</sup>Gaia Converter, France</i>	
<b>D15.3</b>	<b>Analytical Modelling of Single-Phase and Three-Phase DC/DC LLC Converters</b> .....	2106
	Aurora de Juan <sup>1</sup> , Diego Serrano <sup>1</sup> , Pedro Alou <sup>1</sup> , Jean-Nöel Mamousse <sup>2</sup> , Romain Deniéport <sup>2</sup> , Miroslav Vasic <sup>1</sup> <i><sup>1</sup>Universidad Politécnica de Madrid, Spain; <sup>2</sup>Gaia Converter, France</i>	
<b>D15.4</b>	<b>A Series Stacked Modular DC-DC Converter Configuration for Data Center Power Applications</b> .....	N/A
	Ali ElRayyah, Mohamed Badawy <i>San Jose State University, United States</i>	
<b>D15.5</b>	<b>High Efficiency Dual-Output LLC Resonant Converter with Synchronous Rectifier Control</b> .....	2120
	Keon-Woo Kim <sup>1</sup> , Moon-Young Kim <sup>1</sup> , Jeong-Il Kang <sup>1</sup> , Yeonho Jeong <sup>2</sup> <i><sup>1</sup>Samsung Electronics, Korea; <sup>2</sup>University of Rhode Island, United States</i>	
<b>D15.6</b>	<b>Analysis and Design of a 2 MHz GaN-Based Active-Clamped Isolated SEPIC Converter for Low-Power Automotive Subnets</b> .....	2127
	Stefano Cabizza, Luca Corradini, Giorgio Spiazzi <i>Università degli Studi di Padova, Italy</i>	
<b>D15.7</b>	<b>Beat Frequency Oscillation Analysis for Voltage Regulators in Telecom Power System</b> ....	2135
	Xiaolong Yue, Mikael Högrud <i>Ericsson AB, Sweden</i>	

- D15.8 A Monolithic 200V GaN Half Bridge IC with Integrated Gate Drivers and Level-Shifters Achieving 98.3% Peak Efficiency** ..... 2141  
Deniz Aygün<sup>1</sup>, Marc Fossion<sup>2</sup>, Stefaan Decoutere<sup>3</sup>, Andrew Barnes<sup>4</sup>, Christophe Delepaut<sup>5</sup>,  
Jef Thoné<sup>1</sup>, Mike Wens<sup>1</sup>  
<sup>1</sup>MinDCet NV, Belgium; <sup>2</sup>Thales Alenia Space Belgium, Belgium; <sup>3</sup>imec, Belgium;  
<sup>4</sup>European Space Agency, United Kingdom; <sup>5</sup>European Space Agency, Netherlands
- D15.9 RMS Current Based Automated Optimal Design Tool for LLC Resonant Converters** ..... 2146  
Yuqi Wei<sup>1,2</sup>, Thiago Pereira<sup>2</sup>, Yiwei Pan<sup>2,3</sup>, Marco Liserre<sup>2</sup>, Frede Blaabjerg<sup>3</sup>, H. Alan Mantooth<sup>1</sup>  
<sup>1</sup>University of Arkansas, United States; <sup>2</sup>Christian-Albrechts-Universität zu Kiel, Germany;  
<sup>3</sup>Aalborg University, Denmark
- D15.10 A Novel Three Phase LCL Dual Active Bridge Converter to Reduce RMS Phase Current** .... 2154  
Hui Chen, Jinjun Liu, Shaodi Ouyang, Sixing Du, Xianzao Li  
Xi'an Jiaotong University, China