

Industry Session I

Venue: Sky Ballroom 1

Time: 26th November, 2.00pm-3.30pm

| Presentation Topic | Speaker | Time |
|--|--|-----------------|
| 48 V = eGaN [®] Technology | Mr Cheng Cheng-I, Peter Asia Pac FAE Director Efficient Power Conversion Corporation (EPC) | 2.00pm – 2.30pm |
| Loss Measurement of Inductors used in Power Converters | Prof Toshihisa Shimizu Vice President Tokyo Metropolitan University, Japan and IEEE-Fellow, IEEJ-Fellow | 2.30pm – 3.00pm |
| Transformer Design for Common-Mode Noise Reduction | Dr Yu-Kang Lo Director of Product Competence Center (PCC) in Power Conversion BG LITE-ON Technology Corporation, Taiwan | 3.00pm – 3.30pm |

Industry Session II

Venue: Sky Ballroom 1

Time: 27th November, 11.00am- 1.00pm

| Presentation Topic | Speaker | Time |
|---|---|-------------------|
| Dynamically Reconfigurable Motor and Drive Technology | Dr Hengchun Mao President Quanten Technologies Inc, USA | 11.00am – 11.30am |
| MV EV Fast Charging Technology Trend | Dr Herman Chang Senior Vice President Wanbang New Energy Investment Group Co.,Ltd, China | 11.30am – 12.00pm |
| Model-Based Design for Power Electronics Control | Mr Takumi Toyama IA&M Industry Manager MathWorks, USA | 12.00pm – 12.30pm |
| Advances in Power Semiconductors | Mr Rory Dickman Global Account Manager (Switzerland) ABB, Switzerland | 12.30pm – 1.00pm |



Speaker: Mr Cheng Cheng-I, Peter
Asia Pac FAE Director
Efficient Power Conversion Corporation (EPC)

Industry Session Presentation Title: 48 V = eGaN[®] Technology

Abstract: Today the power MOSFET is the most popular power switching device in the world, and GaN-on-Si power devices are the challenger. The early GaN adopters just needed the speed. The big examples were lidar systems for autonomous cars, drones, robots, and 4G/LTE base stations. In the 10 years since the first enhancement mode GaN power devices were introduced, the volume has grown, and now GaN power devices are at a point where the prices are equivalent to the slower, bigger and aging power MOSFET. The next phase in the GaN revolution has begun. In this talk we will show some of the latest high-volume applications for GaN, and quantify the performance, reliability, and cost comparisons on GaN-on-Si with state-of-the-art Si MOSFETs in leading applications for 48 V input power systems.

Biography of Speaker: Cheng Cheng-I, Peter, is the Asia Pac FAE Director at Efficient Power Conversion Corporation (EPC). He works closely with customers in Asia Pac and facilitates their understanding of the characteristics and differentiations of a broad range of EPC products. He joins hands with these customers in the development of new products and design solutions. Peter has 20 years of FAE experience who worked in the capacity of FAE in various international companies. In 1999 to 2000, he was the Senior FAE of Cherry Semiconductor. After Cherry Semiconductor was acquired by On Semiconductor in 1999, Peter then worked as the Senior FAE at On Semiconductor during 2000 to 2001. In 2001, he joined Semtech in Taiwan as Senior FAE. In 2002 to 2005, he was International Rectifier's (now Infineon) Senior FAE. In 2006 to 2010, he worked at Supertex (acquired by Microchip) in Taiwan as FAE. In 2010, he joined EPC as the Asia Pac FAE Manager.



Speaker: Prof Toshihisa Shimizu

Vice President

Tokyo Metropolitan University, Japan and IEEE-Fellow, IEEJ-Fellow

Industry Session Presentation Title: Loss Measurement of Inductors used in Power Converters

Abstract: Power converters that are used in various products (Industrial applications, home appliances, electric cars, etc.) are required to provide higher specifications such as a high power density, high efficiency, and low cost. High-frequency switching with utilizing advanced power devices, such as SiC and GaN, is one effective method to satisfy the above requirements. On the other hand, it becomes clear that reduction of the volume of passive components cannot be achieved even when high frequency switching is applied. In addition, loss generated from the passive component cannot be reduced as we expected and results in the over heat problems in the practical applications. In order to solve the problems, accurate loss calculation and loss measuring method of the passive component used in the power electronics circuit is crucial.

In this presentation, accurate loss calculation and loss measurement of the power inductors used in the power converters is introduced.

This presentation consists of the following contents.

- (1) Trends on Power Converter Technology
- (2) Characterization of Magnetic Components
- (3) Accurate Loss Measurement of Magnetic Materials
- (4) Loss Calculation Using Loss Map Method
- (5) Loss Measurement of High Power Inductors

Biography of Speaker: Toshihisa Shimizu was born in Tokyo, Japan, in 1955. He received the B.E., M.E. and Dr.Eng. degrees all in electrical engineering from Tokyo Metropolitan University in 1978, 1980, and 1991, respectively. He has been a visiting professor at VPEC, Virginia Polytechnic Institute and State University, Virginia, USA, in 1998.

In 1980, he joined Fuji Electric Corporate Research and Development, Ltd. as a research engineer. Since 1993, he has been with Department of Electrical Engineering, Tokyo Metropolitan University, Tokyo, Japan. Now he is a full professor and vice-dean in the same university. His research interests include power converters, high frequency inverters, photovoltaic power generations, UPSs, modeling and reduction of EMI in Power Electronics, high power density converter design, passive component design including loss analysis of inductors and capacitors, etc. He published more than 100 journal papers and 250 international conference proceedings, and 6 technical books. He also holds more than 100 patents and more than 50 patents pending.

Dr. Shimizu has received transactions paper awards from IEEJ in 1999, 2010 and 2016, two first prize paper awards at IPEC2010 -ECCE Asia-, best paper award at EPE-PEMC2010, first prize paper award at IPEC2014 ECCE-Asia, first prize paper awards at IEEE ECCE2015, ECCE2016, ECCE2017, and second prize paper award at ICPE2019 ECCE-Asia.

He is a fellow member of IEEE, and a fellow member of the Institute of Electrical Engineers of Japan.



Speaker: Dr Yu-Kang Lo

**Director of Product Competence Center (PCC) in Power Conversion BG
LITE-ON Technology Corporation, Taiwan**

Industry Session Presentation Title: Transformer Design for Common-Mode Noise Reduction

Abstract: High power density is required for size reduction of power supplies. It is more difficult to be achieved for small-power adaptors or smart device chargers, which usually adopt single-stage topologies. One approach is to minimize the EMI filter network in the input stage for higher efficiency and reduced volume. In this presentation, two commonly-used methods of transformer design to reduce the common-mode (CM) noises are discussed. One is the copper shielding and the other is the cancellation winding. Basic theories are reviewed and experimental results on a 65W/19V adaptor are shown. Smaller Y-Cap results in smaller leakage current, and smaller CM choke leads to reduced core size and core loss.

Biography of Speaker: Yu-Kang Lo was born in Chia-Yi, Taiwan, R.O.C., in 1969. He received the B.S. degree and Ph.D. degree both in electrical engineering from National Taiwan University, Taipei, Taiwan, R.O.C., in 1991 and 1995, respectively. Dr. Lo has been with the faculty of the Department of Electronic Engineering, National Taiwan University of Science and Technology, from 1995 to 2014. His research interests include the design and analysis of a variety of switching-mode power converters and power factor correctors. Dr. Lo also served as directors of Incubation Center, Power Electronics Technology Center, and LiteOn NTUST Power Electronics Center in the university. Dr. Lo has advised or co-advised more than 30 Ph.D. students and 300 Master students. Most of these graduate students work as R&D engineers in the power supply industry. He publishes more than 350 conference papers, 100 journal papers, and holds 23 patents. Dr. Lo has been the PI of 160 government and industry projects, with total budget more than 10M USD. Since 2014, Dr. Lo has joined LiteOn Tech. Corp., and served as director of Product Competence Center (PCC) in Power Conversion BG.



Speaker: Dr Hengchun Mao
President
Quanten Technologies Inc

Industry Session Presentation Title: Dynamically Reconfigurable Motor and Drive Technology

Abstract: In the pursuit of using energy more efficiently and more environmental-friendly, people are replacing internal combustion engines with electrical motors and electrical drives in various vehicle applications, from electrical and hybrid cars, trucks, motor cycles to trains and ships. The motors have to go through wide ranges of torque and speed, and are difficult to optimize for applications with such wide dynamic ranges. Advanced power electronics technologies can help the system to have better performance while being more efficient and more reliable by not only providing required power, but also improving the electromagnetic properties of the motor.

Quanten Technologies' patented dynamically reconfigurable motor (DR Motor) technology can modulate the magnetic field in a motor based on power electronics control, so the pole number and phase number of the motor can be optimally changed during operation to suit the operating condition, resulting in better energy efficiency and power density in the drive system. For example, during a start or low-speed operation, the motor is configured to operate at a high-pole setup, so a high torque can be produced. When the motor enters a high speed operation, the motor can be configured to operate at a low-pole setup with a short and smooth transition, achieving good power output at high efficiency due to the reduced frequency of the currents. In this way, the inherent conflict of low-speed operation and high frequency operation in a motor is resolved by the dynamic configuration in the control system without switching the windings of the motor, enabling high performance operation in dynamic applications. This DR motor technology can be used in automotive, motorcycle, ship, robot, and general industrial applications.

Biography of Speaker: Dr Hengchun Mao got his Ph. D. degree from Virginia Power Electronics Center at Virginia Tech in 1996, and has been working in power electronics and motor drive industries for over 30 years. He was a staff researcher in Bell Labs, the principal architect of Huawei's power and energy department, and a business unit general manager at Diodes Semiconductor. He founded Quanten Technologies, NuVolta Technologies, and NetPower Technologies, respectively in the business of advanced EV drives, wireless charging technologies, and high efficiency power modules. The companies he founded have developed over a dozen industry-leading product families, and was awarded in Silicon 60 and Electronic Design Hot 100.

Dr Mao has been conducting research in high frequency power converter topology, soft-switching technology, advanced power architecture, wireless charging, novel motor structure and advanced drive control. He has authored over 100 US patent applications in these areas.



Speaker: Dr Herman Chang
Senior Vice President
Wanbang New Energy Investment Group Co., Ltd.

Industry Session Presentation Title: MV EV Fast Charging Technology Trend

Abstract: In order to reduce the CO₂ emission and increase the energy utilization efficiency, plug-in EVs has become a major trend to achieve this goal. The EV makers have put more and more resource to develop the long driving range EV to release the driver anxious. Those EVs have larger battery capacity and required higher power which might go up to MW to quickly fill the energy in a short break. Normally, those chargers would connect the Medium Voltage (MV) power line and set up along the highway or main road. Therefore, different MV input charging solution have been developed to fulfill these requirements and the goal is to provide high energy efficient with price competitive and smart-grid management function with integrated renewable energy to support the utility grid.

Biography of Speaker: Dr Herman Chang graduated from National Cheng Kung University and has published 8 papers and 64 invention patents. He is Director of Power Electronics Association, advisory-board member of National Taiwan University Energy Research Center, honor-chairman of the Power & Compound Semiconductor Association. Herman is awarded as distinguished and outstanding alumni by National Taipei University of Technology.



Speaker: Mr Takumi Toyama
IA&M Industry Manager
MathWorks

Industry Session Presentation Title: Model-Based Design for Power Electronics Control

Abstract: Model-Based Design with Simulink helps engineers develop digital controllers for power electronics systems by enabling them to gain insight into the dynamic behavior of the system, quickly explore different power electronic topologies, test operational cases, and begin hardware testing early, reducing design errors.

Using Simulink, they model and simulate a digitally controlled buck-boost converter for control algorithm design, and generate C or HDL code for implementing a production-quality digital controller and for real-time simulation and testing of power electronics systems.

In this session, we introduce how Model-Based Design enable you to:

- Size passive components using Simulink and Simscape Electrical to optimize inductors and capacitors and understand converter behavior in continuous and discontinuous conduction modes.
- Estimate the nonlinear switching dynamics of the MOSFET and determine power losses and simulating thermal behavior
- Design and automatically tune a PID control
- Implement a digital controller for a buck-boost converter on a Texas Instruments™ TMS320F28035 microcontroller
- Perform hardware-in-the-loop (HIL) testing of a digital controller for a buck-boost converter using Simscape Electrical™ and a Simulink-Programmable FPGA from Speedgoat
- Perform rapid control prototyping (RCP) of a brushless DC motor controller using Simulink Real-Time™ and a Speedgoat real-time target machine

Biography of Speaker: As an Industry Manager for the Industrial Automation & Machinery industry, Takumi leads the marketing and business development effort to foster industry adoption of MathWorks products for Model-Based Design of embedded systems for 10+ years.

Prior to joining The MathWorks, Takumi worked for Cybernet Systems that was the MathWorks distributor in Japan as Control Design Automation Product manager and IA&M Industry Manager.

Takumi also worked for Endress+Hauser as Product Manager, and for Keyence as Technical Marketing. Takumi holds a B.Sc. in Mechanical Engineering of Kobe University.



Speaker: Mr Rory Dickman
Global Account Manager (Switzerland)
ABB

Industry Session Presentation Title: Advances in Power Semiconductors

Abstract: “Advances in Power Semiconductors” provides an overview of product technologies which demonstrate key attributes of performance, reliability and higher power. This presentation highlights some key benefits to support end-customers in deciding on the relevant power semiconductor for the given application. Applications vary notably and can be depicted in terms of power range and device blocking voltage. Products showcased in this presentation include the LoPak and 62Pak, the IGBT LinPak, HiPak and StakPak, the IGCT, and an EV module.

Biography of Speaker: With more than 20 years international experience in industrial and technology sectors, Mr. Rory Dickman is a business manager with double degree in engineering (U.S.) and MBA (Switzerland). He has broad and in-depth background in various semiconductor industries (Industrial High Power, Automotive Powertrain, Memory DRAM ICs, and RF Components). Mr. Dickman has joined ABB in 2012 and currently leads sales and business development in Asia (China, Japan, India, South Korea, Taiwan and Southeast Asia) and global accounts (direct/OEM).