iTEC2017

2017 IEEE Transportation Electrification Conference and Expo

Components, Systems, and Power Electronics - From Technology to Business and Public Policy

ITEC is aimed at helping industry in the transition from conventional vehicles to advanced electrified vehicles

Final Program

Navy Pier,
Chicago, IL USA
June 22-24, 2017

ITEC Sponsors

IEEE | pels IEEE POWER ELECTRONICS SOCIETY | IEEE PES Power & Energy Society | IAS IEEE INDUSTRY APPLICATIONS SOCIETY Linking Research to Practice

Welcome Letter

It is with great pleasure that I welcome the industry, academia, government agencies, and the public to the 2017 IEEE Transportation Electrification Conference and Expo (ITEC'17). In this 6th year of the conference, ITEC continues to help the industry transition from non-electric to more and all electric forms of transportation including land, sea, air, and rail vehicles covering the electrification of both propulsion and non-propulsion systems and components.

Education, health, employment, and quality of life are all important to our society. But transportation is a key enabler to achieve any and all of these. Our lives all depend on high quality, fast, economic, and environmentally friendly transportation. ITEC is a unique event that brings experts together to explore the recent advancements, opportunities, and challenges in transportation electrification.

The 2017 IEEE Transportation Electrification Conference and Expo will be held on June 22-24 at Navy Pier in Chicago, IL. Navy Pier is one of the most visited landmarks in Chicago with breathtaking views of Lake Michigan. In the past 5 years, ITEC has been held at the heart of the auto industry in Detroit metro area. This is the first year that ITEC is going out of Detroit to explore the advancements and needs in the other industry segments including rail, aerospace, off-road and heavy-duty vehicles and the tier-1 and 2 manufacturers and suppliers in the region while the other core ITEC areas remain equally important.

ITEC'17 offers an excellent conference program and exhibition focused on the needs of the industry. This year we will have 12 very diverse, top-notch keynote speakers who are the leading experts in the industry. Additionally, ITEC'17 offers timely and highly relevant short courses, tutorials, and industry panel sessions. Furthermore, we will have a very large industry exhibition focused on systems, subsystems, and components for transportation systems covering batteries, prototyping and testing equipment, power electronic converters including traction drive and charging systems, and the design and development examples of industry products. The program also includes about 150 high-quality technical paper presentations. This year, the organizing committee added more technical tracks to the conference program. The first of these tracks is Thermal Management, Packaging, and Optimization of Traction Drive Systems. Nowadays in traction inverters, the greatest accomplishments in specific power, power density, volume, and cost have been achieved through thermal management, materials, and packaging of the systems while topological achievements have always been of great interest to ITEC. Connected and autonomous vehicles, smart mobility, and vehicle cyber security are the other emerging topics in our era of transportation electrification that will be covered at ITEC'17. This year, we are also having a pre-conference welcome reception on June 21st, 2017 with a vehicle display event from Toyota where they will display, drive, and present the world's first commercially available fuel cell electric vehicle, the Toyota Mirai. The vehicle display event will take place at the Herman Hall at the Illinois Institute of Technology campus (3124 S. Federal St. Chicago, IL 60616) starting at 5.30pm. The welcome reception with vehicle display event is open to all ITEC attendees and their guests.

We look forward to welcoming you at ITEC'17 on June 22-24 at Navy Pier, Chicago, IL to discuss and learn more about the current status, progress, emerging technologies, and future trends in transportation electrification and to collaborate with your fellow peers who are working on this paradigm shift of our century. We are enthusiastically looking forward to meeting you at ITEC and hope you have a memorable experience.

Omer C. Onar
General Chair, ITEC'17

You will experience….

ITEC is focused on components, systems, standards, and grid interface technologies, related to efficient power conversion for all types of electrified transportation for electric, hybrid electric, and plug-in hybrid electric vehicles (EVs, HEVs, and PHEVs) as well as heavy-duty, rail, off-road vehicles, airplanes and ships.

5 Short Courses

5 Tutorials

Industry Special Session

Industry Exhibition

12 Keynote Presentations

Pre-Conference Welcome Reception

7 Panel Sessions

150 Papers Presented

19 Technical Sessions

Networking Dinner

Keynote Speakers

It's About The Knowledge Shared...

Michael Tamor
Henry Ford Technical Fellow,
Energy and Sustainability,
Ford Motor Company

Steven Tarnowsky
Director,
Global Transmission & Electrification,
Advanced & New Product Engineering,
General Motors

Jeffrey Casady
Business Development
and Program Manager,
Wolfspeed/CREE

Nicholas Nagel
Director of R&D,
Triumph Aerospace

Jiaqi Liang
Director of Power Electronics,
Hyperloop-One

Richard Hampo
Senior Director of Engineering and
Traction Inverters,
Delta Products Corporation

Kent Wanner
Sr. Staff Power Electronics Design
Engineer,
John Deere Electronic Solutions

Silva Hiti
Senior Director,
Powertrain Engineering
Faraday Future

Julian Styles
Director, Sales and Marketing
Americas,
GaN Systems

John Nairus
Chief Engineer,
Power & Control Division,
The Air Force Research Laboratory

Adel Nasiri
Director,
Center for Sustainable
Electrical Energy Systems,
University of Wisconsin-Milwaukee

Mengyang Zhang
VP of Engineering,
Skysource Nanjing
Powertrain Technology
CTO, Nanjing Golden Dragon Bus Co.

It's About Collaboration...

All conference registrants are welcome to attend the panel discussions, which are in parallel with technical sessions, at no additional charge.

Panels are 80 minutes in duration and are scheduled in the afternoons of Thursday (June 22, 2017) and Friday (June 23, 2017).

At each panel, the panel moderator/organizer and panelists will each give a short 5-10 minute presentation/speech and then the floor will be opened to the audience for open panel discussions and Q&A.

Panel 1

"What Software Engineering Fundamentals do Engineers Need to Know for Model Based Development of Embedded Code?"

Panel 2

"Wireless Charging of Electric Vehicles"

Panel 3

"Polyphase Electric Machine Applications for Traction Drive Systems"

Panel 4

"The Future of Self-Driving Vehicles – Autonomous Driving Technical Insights"

Panel 5

"High Voltage Components and ePT Architectures for PHEV, HEV, and EV Applications"

Panel 6

"More Electric Aircraft Applications"

Panel 7

Electric Motor Whine, NVH – Challenges and Solutions

Short Courses & Tutorials

Short Course 1
"Power Semiconductors for Traction Inverters in Vehicles: From Discretes to Power Modules, from Silicon to Wide Bandgap Devices "

Short Course 2
"Thermal Management Solutions in Power Electronics"

Short Course 3
"Modern Heuristics Algorithms for Automotive Applications"

Short Course 4
"Fundamentals and Practical Design of Traction Drive Inverter for Hybrid Electric Vehicles"

Short Course 5
"Tool Support for Model Based Software Engineering in MATLAB/Simulink for Domain Experts"

Tutorial 1
"Advanced Magnetic Materials for your Application"

Tutorial 2
"Building Fast and Accurate Powertrain Models for HEV System and Control Development"

Tutorial 3
"Fundamentals for More Electric Aircraft Design"

Tutorial 4
"Fundamentals of Battery Electrochemistry and Control of Electric Vehicle Batteries"

Tutorial 5
"Power Line Communications for Vehicular and Smart Grid Applications"

Industry Special Session: "Testing Drive Inverter Performance with a Virtual E-Motor (PHiL), *Horst Hammerer, CEO, SET Power Systems GmbH*, AVL Group

IEEE Continuing Education Units

Educational Short-Courses and Tutorials at ITEC'17 are offered by internationally renowned experts from industry and academia. The content and the quality of the courses have passed IEEE's strict criteria for educational excellence and they are entitled to award IEEE Continuing Education Units (CEUs), recognized as the standard of excellence for continuing education programs in IEEE's fields of interest.

In the United States, many states require professional engineers to obtain Professional Development Hours (PDHs) for maintaining licensure. Through IEEE's continuing education offerings, professional engineers can earn PHD certificates that can be used as evidence of participation in these courses to help meet their requirements activity (1 CEU=10 PDHs).

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Omer C. Onar
Oak Ridge National Laboratory, USA

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Sanjaka Wirasingha, *Valeo, USA*
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Long Wu, *John Deere, USA*

Battery Industry Liaison Chairs

Said Al-Hallaj, *All Cell Technologies, USA*
Pavel Dutov, *LG Chem, USA*

Meeting Room Floor Plan

Keynote Sessions
Rooms 325-326

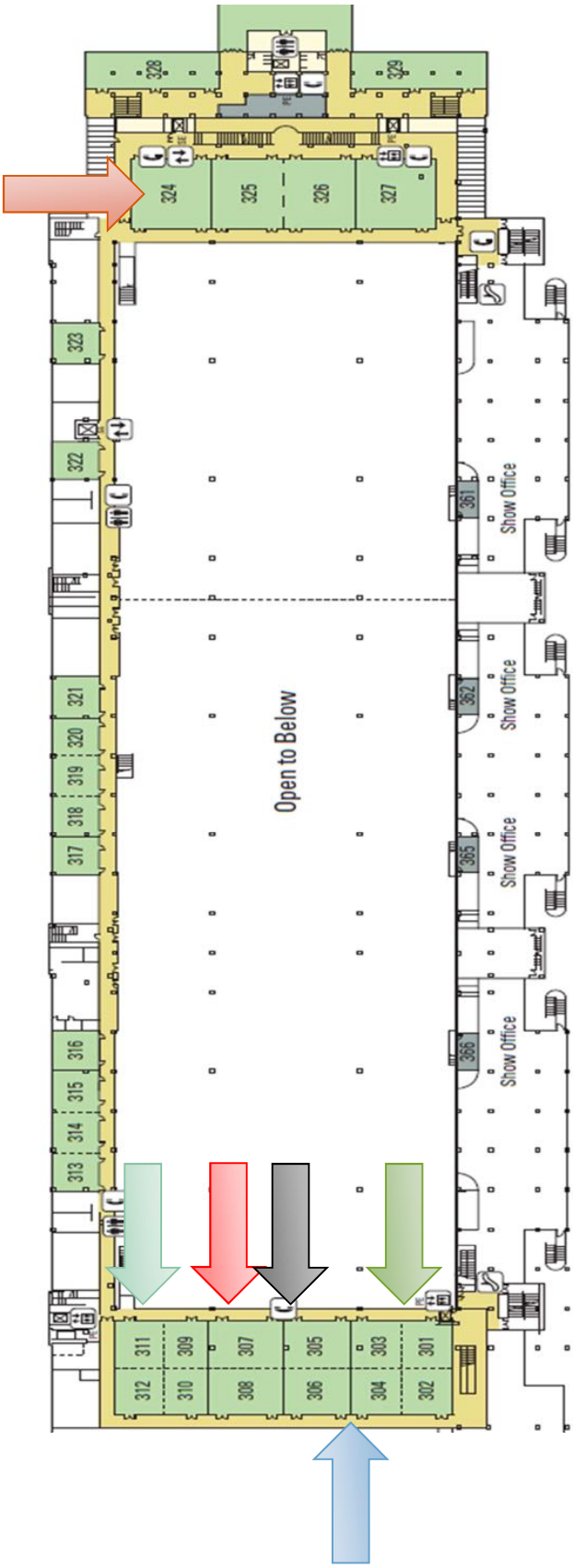
Panel Sessions
Rooms 302-303

Tutorials
Rooms 302, 307-308

Short Courses
Rooms 305-307

Industry Technical Presentation
Room 311

Technical Sessions
Rooms 301-305
June 24th only



ITEC'17 Program-at-a-Glance

Program-at-a-Glance
2017 IEEE Transportation Electrification Conference and Expo (ITEC'17)
June 22-24, 2017

	7:30AM-8:30AM	8:30AM-10:10AM	10:10AM-10:30AM	10:30AM-12:00PM	12:00PM-2:00PM	2:00PM-3:20PM	3:20PM-4:20PM	4:20PM-5:40PM	5:40PM-7:30PM
Wednesday June 21, 2017	Conference Registration Open								Pre-Conference Welcome Reception and Toyota Presentation
Thursday June 22, 2017		Plenary Session 1	Break in the plenary room hallway Coffee Break	Plenary Session 1	Poster Session 1 Exhibit Hall Buffet Lunch	Short Course 1 Short Course 2 Short Course 3 Tutorial 1 Panel 1 Panel 2 Industry Special Session	Break in the Exhibit Hall Coffee Break	Short Course 1 Short Course 2 Short Course 3 Tutorial 2 Tutorial 3 Panel 3	Networking Dinner in Exhibit Hall
Friday June 23, 2017		Plenary Session 2	Break in the plenary room hallway	Plenary Session 2	Poster Session 2 Exhibit Hall Buffet Lunch	Short Course 4 Short Course 5 Tutorial 4 Panel 4 Panel 5	Break in the Exhibit Hall	Short Course 4 Short Course 5 Tutorial 5 Panel 6 Panel 7	Ice Cream Social in Exhibit Hall
Saturday June 24, 2017		8:30 AM-10:10 AM Technical Sessions 1-5	Break near technical session rooms	10:30 AM-12:10 AM Technical Sessions 6-10		2:00 PM-3:40 PM Technical Sessions 11-15	Break near technical session rooms	4:00 PM-5:40 PM Technical Sessions 16-19	

Pre-Conference Welcome Reception and Toyota Display Event

ITEC 2017 is pleased to announce that Toyota Motor North America will be giving a presentation on Wednesday, June 21st, 2017 at 5:30 PM.

Location

Illinois Institute Of Technology
Herman Hall Ballroom
3124 S Federal St.
Chicago, IL 60616

This event is open to all registered attendees of ITEC '17 and invited speakers. For those interested in attending only the event, on-site registration will be available. The Toyota Mirai is a hydrogen powered fuel cell electric vehicle which is one of the first such vehicles on the market. The vehicle display event will include presentations from Toyota engineers on the technical details, performance, and design information of the vehicle.

WELCOME RECEPTION TO FOLLOW THE PRESENTATION

TOYOTA

Pre-Conference Welcome Reception and Toyota Display Event

Continuous Improvements and Advancements in Toyota Fuel Cell Technology

The Toyota Mirai continues to sculpture new ways towards zero emission mobility in our future. We have been learning a great deal, making improvements and advancements in our fuel cell program. This presentation describes the latest achievements of this cutting edge technology.

Hitoshi Nomasa, Project Manager, MS Product Planning – Mid-size Vehicle Company, Toyota Motor Corporation
Steve Duh, Senior Manager, Powertrain System Control Department – Fuel Cell Vehicle Group, Toyota Motor North America R&D

Hitoshi Nomasa is the Project Manager of Toyota's Mid-size Vehicle Company, Product Planning Group (MSZ) at Toyota Motor Corporation, located in Toyota-city, Aichi, Japan. MSZ is responsible for overall vehicle development. Mr. Nomasa began his journey at Toyota in 1992, when he joined the company as a member of the Product Evaluation and Engineering Div. Since 2001 he had been involved in the development of transmission as a designer. Nomasa transitioned to Product Planning Group in 2008 responsible for the development of Prius C from the beginning. After that he has been a project manager for the development of the MIRAI Fuel Cell Vehicle.

Steve Duh is the Senior Manager of Toyota's Powertrain System Control – Fuel Cell Vehicle Group (PSC-FCV) at Toyota Motor North America Research & Development (TMNA R&D, formerly known as Toyota Technical Center), located in Gardena, California. FCV responsibilities include vehicle development, component testing, H2 station reliability testing, and North American codes & standards development. Mr. Duh began his journey at Toyota since 1999, when he joined the company as a member of the Quality Assurance Chassis Group of Toyota Motor Sales in North America located in Torrance, California. Throughout the development of his career, Steve transitioned to TMNA R&D in 2004 and has been actively involved in various key vehicle design activities including chassis design, engine calibration, and finally in fuel cell. Mr. Duh earned a Bachelor of Science degree in Mechanical Engineering from California State University of Pomona in 1999.

TOYOTA

Thursday June 22, 2017

Keynote Presentations

Plenary Session 1
Thursday, June 22, 2017
8:30AM – 12.00PM
Venue: Rooms 325-326

Plenary Session Chairs:
Ali Emadi, McMaster University
Mahesh Krishnamurthy, Illinois Institute of Technology
Anand Sathyan, FCA US LLC

Welcome and Introduction
8.30AM-8.35AM
Omer C. Onar, Oak Ridge National Laboratory
General Chair, 2017 IEEE Transportation Electrification Conference & Expo

Keynote Presentation 1: Towards Carbon Neutral Transportation

8.35AM – 9.05AM

Speaker: *Michael Tamor*
Henry Ford Technical Fellow,
Energy & Sustainability,
Ford Motor Company

Short Biography: Michael Tamor received his B.S. in Physics from UCLA in 1977, and his PhD in Physics from the University of Illinois at Urbana-Champaign in 1982. In late 1982 he joined the Physics Department of the Scientific Research Laboratory at Ford Motor Company. From 1982 to 1994 Dr. Tamor conducted research on novel, variable band-gap semiconductors, super-hard, low-friction diamond and diamondlike coatings, and electronics for high-temperature operation. In 1994 he joined the Alternative Power Source Technology Department where he lead development of hybrid electric vehicle (HEV) system modeling and optimization methodology, and optimal control and energy management strategies. In 2005 Dr. Tamor was appointed Executive Technical Leader for Hybrid Vehicle and Fuel Cell Research and took on additional responsibility for development of efficient, cost-effective fuel cell propulsions systems. As Ford's hybrid and electric vehicle programs moved to production, Dr. Tamor's focus shifted from vehicle technology development to global electrification, renewable fuel and energy systems research. In 2013 he was appointed Henry Ford Technical Fellow for Energy Systems and Sustainability. His present responsibilities include studies of global vehicle usage and future mobility needs, the evolving integration of the stationary and mobile energy economies, and the potential for true commercialization of renewable fuel, as well as direct support to product programs and corporate strategic technology planning. Dr. Tamor is a Fellow of the American Physical Society, has published over 70 refereed journal articles with over 2000 citations, authored chapters in four books, holds 56 US patents, and has contributed to several National Academy studies of transportation and technology issues. In 2011 he was named to the Automotive News 'Electrifying 100' list of leaders in vehicle electrification.

Thursday June 22, 2017

Keynote Presentations

Keynote Presentation 2: Status of SiC development for Electric-Drive Vehicles

9.05AM – 9.35AM

Speaker: *Jeffrey Casady*
Business Development and Program Manager, Wolfspeed/CREE

Short Biography: Dr. Casady has 20+ years of management experience in business development, marketing, semiconductor research, and manufacturing experience in a combination of industry / academic settings: Cree (NASDAQ: CREE), Northrop Grumman (NYSE: NOC), SemiSouth Laboratories, Inc. (start-up), University of Missouri, Auburn University, & Mississippi State University. Dr. Casady has published over 80 technical publications, three book chapters, and seven patents, all in SiC power semiconductor technology. From 2012 through today Dr. Casady is working for Cree, in various roles including SiC Product Management, SiC Power Marketing Director, and since 2013 in Business Development and Program Management. He holds a Ph.D. in Electrical Engineering from Auburn University, and B.S.E.E. from the University of Missouri.

Keynote Presentation 3: Hyperloop and the Future of Transportation

9.35AM – 10.05AM

Speaker: *Jiaqi Liang*
Director of Power Electronics, Hyperloop-One

Short Biography: Dr. Jiaqi Liang is the Director of Power Electronics at Los Angeles–based Hyperloop One. He is responsible for the power electronics and power distribution systems that provide multi-megawatts of controllable power to the Hyperloop propulsion systems. In early 2016, he was part of the technical core team to deliver the first Hyperloop propulsion test in Nevada, including the linear motor propulsion and segment handoff implementation. Currently, he continues leading the power electronics development efforts, focusing on functional enhancements, platform development, reliability and fault tolerance designs, and system cost reduction. Prior to joining Hyperloop One, Jiaqi worked at ABB as a power electronics R&D scientist and R&D project leader. He was the key contributor in multiple development projects for high power applications, including HVDC converters, marine dc distribution systems, and converters for heavy hybrid electric vehicles. He has co-authored more than 30 technical journal and conference papers, and holds 4 patents. Jiaqi earned his Bachelor's degree in electrical engineering from Tsinghua University in Beijing, China, and the M.S. and Ph.D. degrees in electrical engineering from Georgia Institute of Technology in Atlanta, Georgia.

Thursday June 22, 2017

Keynote Presentations

Coffee Break
10.05AM – 10.30AM

Keynote Presentation 4: Delivering Customer Value Through Vehicle Electrification at John Deere

10.30AM – 11.00AM

Speaker: *Kent Wanner,*
Sr. Staff Power Electronics Design Engineer,
John Deere Electronic Solutions

Short Biography: Kent Wanner is a Sr. Staff Power Electronics Design Engineer at John Deere Electronic Solutions (JDES) in Fargo, ND. After receiving his BSEE in 1996 from North Dakota State University in Fargo, he joined the Electronic Design Department of Phoenix International (now JDES). He spent the next decade designing robust controllers, displays, sensors, and telematics systems for ruggedized vehicle applications. In 2007, Kent became a Design Team Lead in power electronics, applying his vehicle application design expertise to vehicle electrification projects. He and his team have been recognized within John Deere, receiving numerous awards for outstanding innovation, collaboration, and product commercialization in the areas of power electronics and vehicle electrification. He has numerous patents and industry publications related to power electronics and electric motor drive systems. In his current role he provides hands-on vehicle electrification technical leadership for a wide variety of John Deere and non-competing OEM ruggedized vehicle platforms.

Keynote Presentation 5: Gallium-Nitride Transistors in the EV World

11.00AM – 11.30AM

Speaker: *Julian Styles,*
Director, Sales & Marketing Americas,
GaN Systems

Julian Styles has been working with innovative technologies for over 25 years. He helped develop the technology behind digital cellphones, digital audio broadcast, on-board fast charging for EVs, and grid stability management using EV chargers; and his teams were among the first to integrate personal digital devices, heads-up displays, MP3s and proximity sensing into vehicle interiors. He now works for GaN Systems USA, in Ann Arbor, MI, where he is responsible for introducing the company's advanced gallium nitride power semiconductors to the US market.

Keynote Presentation 6: Design, Implementation, and Testing of a 8000HP Electric Mining Shovel

11.30AM – 12.00PM

Speaker: *Prof. Adel Nasiri, Director, Center for Sustainable Electrical Energy Systems, University of Wisconsin-Milwaukee*

Short Biography: Adel Nasiri is presently a Professor of Electrical Engineering and Associate Dean for Research in the College of Engineering and Applied Science at the University of Wisconsin–Milwaukee, where he is also the director of Center for Sustainable Electrical Energy Systems. His research interests are energy conversion, microgrids, and energy storage. Dr. Nasiri has been the primary investigator of several federal and industry funded research projects and has published numerous technical journal and conference papers on related topics. He also holds seven patent disclosures. Dr. Nasiri is currently an Editor of IEEE Transactions on Smart Grid, Associate Editor of IEEE Transactions on Industry Applications, Associate Editor of the International Journal of Power Electronics, and an Editor of Journal of Power Components and Systems. He has also been a member of organizing committee for IEEE conferences including general chair of IEEE SLED 2012, Technical Vice-Chair for 2013-2016 IEEE ECCE, general chair for the 2014 IEEE PEMWA and 2014 ICRERA. He is also the vice-chair for IEEE IAS Committee on Renewable and Sustainable Energy Conversion Systems.

Thursday, June 22, 2017

Poster Session 1

Thursday, June 22, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chairs: Anand Sathyan, FCA US LLC & Suman Debnath, ORNL

Paper Id	Title/Author
1006	**Preliminary Study for Implementation of Hysteresis Modulator Using TI's TM320F28377D Dual Core DSP for IM Drive,** *Chunki Kwon, Dongsik Kim, Soonchunhyang University*
1007	**Efficiency Study at Light Load Operation for AQDM Based Adaptive MTPA Control for IM Drive,** *Chunki Kwon, Dongsik Kim, Soonchunhyang University*
1018	**A Stochastic Optimization Technique for Discrete DC Capacitor Bank Design,** *Michael Eull, Matthias Preindl, Columbia University, Ali Emadi, McMaster University*
1021	**Scaling Process of Synchronous Reluctance Machines for Automotive Applications,** *Henning Schillingmann, Christian Heister, Markus Henke, Technische Universität Braunschweig*
1033	**Efficiency Enhancement of Wireless Charging for Electric Vehicles Through Reduction of Coil Misalignment,** *Vatsala Vatsala, Aqueel Ahmad, Mohammad Saad Alam, Aligarh Muslim University, Rakan C. Chaban, Hyundai Kia Motors*
1034	**High Power Inductive Charging System for an Electric Taxi Vehicle, *Markus Henke,*** *Tim-Hendrik Dietrich, Technische Universität Braunschweig*
1035	**Influence of Active Battery Switching on the Drivetrain Efficiency of Electric Vehicles,** *Philip Wacker, Lukas Wheldon, Martin Sperlich, Jörn Adermann, Markus Lienkamp, Technische Universität München*
1036	**Design and Implementation of a Transmission System for High-Performance Contactless Electric Vehicle Charging,** *Benjamin Klaus, Daniel Barth, Björn Sillmann, Thomas Leibfried, Karlsruher Institut für Technologie*
1040	**Measurements and Analysis of Battery Harmonic Currents in a Commercial Hybrid Vehicle,** *Rudi Soares, Alexander Bessman, Oskar Wallmark, Göran Lindbergh, Pontus Svens, Royal Institute of Technology*

Thursday, June 22, 2017

Poster Session 1

Thursday, June 22, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chairs: Anand Sathyan, FCA US LLC & Suman Debnath, ORNL

Paper Id	Title/Author
1048	**System Architecture of a Full Active Autonomous Electric Vehicle,** *Xiaobo Liu-Henke, Soeren Scherler, Marian Goellner, Ostfalia University of Applied Sciences*
1064	**Evaluation of Strategies for Electric Vehicle Management of an Aggregator Based on Modulation of Charging Power Rate,** *Jean-Michel Clairand, Universidad de las Américas, Javier Rodríguez García, Carlos Álvarez Bel, Universidad Politécnica de Valencia*
1068	**Direct Predictive Control of Five-Level Dual Flying Capacitor Active Neutral Point Clamped Converters with Extended Horizons,** *Zhenbin Zhang, Jochen Schenek, Wei Tian, Ralph Kennel, Technische Universität München*
1081	**Reactive Power Generation for Single-Phase Transformerless Vehicle-to-Grid Inverters: a Review and New Solutions,** *Ehsan Afshari, Northeastern University, Gholam Reza Moradi, Alireza Ramyar, Ramin Rahimi, University of Tehran, Babak Farhangi, Current Ways Inc., Shahrokh Farhangi, University of Tehran*
1089	**An Integrated Three-Port Bidirectional Converter for Hybrid Energy Storage Systems in Electrified Vehicle Applications,** *Ricardo Aguilar-Najar, Instituto Tecnologico de Celaya, Ruoyu Hou, Ali Emadi, McMaster University, Francisco Perez-Pinal, Instituto Tecnologico de Celaya*
1099	**Predictive Torque Control of Induction Machines Fed by 3L-NPC Converters with Online Weighting Factor Adjustment Using Fuzzy Logic,** *Zhenbin Zhang, Wei Tian, Wanyi Xiong, Ralph Kennel, Technische Universität München*
1101	**A Cascaded High Frequency AC Link System for Large-Scale PV-Assisted EV Fast Charging Stations,** *Nour Elsayad, Osama A. Mohammed, Florida International University*
1102	**Thermal Energy Storage for Increasing Heating Performance and Efficiency in Electric Vehicles,** *Antti Lajunen, Trevor Hadden, Rafat Hirmiz, James Cotton, Ali Emadi, McMaster University*

Thursday, June 22, 2017

Poster Session 1

Thursday, June 22, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chairs: Anand Sathyan, FCA US LLC & Suman Debnath, ORNL

Paper Id	Title/Author
1103	**Improved Combined Modulation Strategy for Dual Active Bridge Converter in Electrified Vehicles,** *Ying Cui, Ruoyu Hou, McMaster University, Pawel Malysz, Fiat Chrysler Automobiles, Ali Emadi, McMaster University*
1108	**State of Health Estimation of Li-Ion Batteries Using Electrochemical Impedance Spectroscopy,** *Hassan Shabbir, Cadex Electronics Inc., William Dunford, University of British Columbia, Tina Shoa, Cadex Electronics Inc.*
1088	**Online Energy Management Strategy of Fuel Cell Hybrid Electric Vehicles Based on Time Series Prediction,** *Daming Zhou, Fei Gao, Alexandre Ravey, Université de Technologie de Belfort-Montbéliard / FEMTO-ST Institute, Ahmed Al-Durra, Petroleum Institute, Marcelo Godoy Simões*
1146	**A Method for Masterless Self-Assigning CAN Bus Identifier, *Felix Roemer, Matthias Lamparter,*** *TUM CREATE Singapore, Markus Lienkamp, Technische Universität München*
1027	**Adaptive State of Charge Estimation Based on a Split Battery Model,** *Jufeng Yang, Bing Xia, Yunlong Shang, San Diego State University, Wenxin Huang, Nanjing Unversity of Aeronautics and Astronautics, Chris Mi, San Diego State University*

Short Course 1: Power Semiconductors for Traction Inverters in Vehicles: From Discretes to Power Modules, from Silicon to Wide Bandgap Devices

Thursday, June 22nd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in the Exhibit Hall)
Venue: Room 305

Instructors: *Dr. Andre Christmann & Dr. David Levett, Infineon Technologies Americas Corp.*

Course Description: This tutorial will provide an overview of the use of power semiconductors in vehicle traction inverter applications. It will cover four major aspects of three-phase inverters for DC-AC power conversion in HEVs, PHEVs, and EVs:

- Semiconductor packaging
- Performance assessment of different families of semiconductors: IGBTs, MOSFETs and SiC
- Inverter design principles for high efficiency
- Integration of different package types into an Inverter

IGBTs (Insulated Gate Bipolar Transistors) are at the heart of most modern traction inverters and perform the electronic switching functions. They are assembled in different kinds of packages, mounted onto cooling structures and connected via bus bars to a capacitor bank. A fully functional inverter stack compromises of these components integrated together with other subassemblies, such as control boards, filters and current sensors. Although the market for electrical and hybrid cars cannot be described as an emerging market, the typical standardization of automotive components has not yet occurred for high power inverters. There are still a lot of different architectures in the OEM landscape and even within the same company you can find several inverter designs for different vehicle platforms. Nevertheless, the physics for driving an electrical motor are the same for all the different vehicles. The tutorial will connect various aspects of inverter design from the view point of power semiconductors: Packaging, thermal and electrical performance and the integration into an inverter.

Packaging:
Different power semiconductor packages and their integration into inverter systems will be compared. For example, an approach with discrete components and a power module based inverter will be discussed by using Figure of Merits for key design parameters. To decrease power losses - and improve inverter efficiency - semiconductor devices are designed to switch quickly between on and off states. Faster switching decreases the semiconductor turn-on and turn-off losses, but increases the associated voltage and current transients. Therefore, the stray inductance, which is responsible for overvoltage in the system, is one of the key parameters.

Thermal Design, Electrical Performance and Efficiency:
Both the device and the package performance strongly influence the inverter efficiency, which, in turn, impacts battery life and MPG(e) rating of the vehicle. A qualitative assessment of power losses for different operation conditions will be shown for different semiconductor types as well as several package types.

Inverter Integration:
Apart from the electrical and thermal performance there are several key parameters of power semiconductor switches that must be considered for example: Inverter design effort, size, performance, scalability, manufacturability, reliability, BOM cost and manufacturing costs. Advantages and disadvantages of the different packages will be discussed during the tutorial.

Instructors' Short Biographies:

André Christmann after completing his PhD worked for 3 years at the Fraunhofer Institute for Microelectronic Circuits and Systems in the area of power semiconductor development. From 2004 - 2011 he was responsible for the development of power semiconductor modules for electrical applications in vehicles at Infineon Technologies AG (Warstein, Germany). During this time he was heavily involved in the HybridPACK 1 power module development, which is now an industry wide standard footprint for automotive power semiconductor modules. In 2011 he transferred to Infineon North America where he took over a position as System Application Engineer in the area of power semiconductor modules. Dr. Christmann is author/co-author of several publications, lead classes in seminars and gave presentations on international conferences like APE, PCIM, ITEC and ECCE. He also holds patents on power module design.

David Levett earned his degree and PhD in electrical engineering from the University of Southampton, UK, specializing in motor drives and controls. He has 25 years of power electronics experience both in Europe and the USA designing IGBT-based power converters. David has specialized in the field of motor drives and has experience with switched reluctance, servo, induction, and modular drive systems in the 5Hp – 500Hp power range. He has also designed grid tie and vehicle traction converters. David has worked for the last 7 years as a Design and Applications Engineer for Infineon Technologies.

Short Course 2: Thermal Management Solutions in Power Electronics

Thursday, June 22nd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in the Exhibit Hall)
Venue: Room 306

Instructor: *Dr. Ahmed Zaghlol, General Manager, Americas Cooling Products, Electrical Power, Mersen Canada Toronto, Inc.*

Course Description: This course gives an overview of the thermal management for power electronics. As the density of circuits increases, so does the need to develop effective methods of thermal management and packaging. This need arises not only in the context of high-speed computers but also, in future UPS, power supplies, Converters, Variable speed motor drives, RF and Microwave amplifiers and automotive applications. This course helps engineers to develop thermal management knowledge that address both emerging thermal challenges and significantly improve thermal performance. This course is designed to provide participants with an over view of the necessary tools to perform thermal modeling and analysis of electronic systems. The fundamental and applied methods for a successful design are covered, and modeling tools are reviewed. The course outline will include the following topics:
– Definition of electronics cooling and encountered challenges.
– General problem solving technique for solution of thermal problems.
– Heat transfer and fluid mechanics fundamentals as applied to electronics cooling.
– Thermal design for the interface between the device and the heat sink.
– Heat sink design with reference to performance and overall system design.
– System thermal and Hydraulic performance.

Instructor's Short Biography:

Dr. Ahmed Zaghlol is the General Manager of the Americas Cooling Products, Electrical Power, Mersen Canada Toronto, Inc. located in Mississauga; a global company specializing in Electric and Thermal protection for Electric and Electronic circuits. Dr. Zaghlol received his Bachelor degree in Mechanical Engineering from the University of Alexandria, Egypt where he also obtained his Master degree. He received his Ph.D. in Engineering Science from the University of Western Ontario and later joined the Microelectronic Heat Transfer Laboratory (MHTL) at the University of Waterloo as postdoctoral Fellow. Since joining Mersen (Formerly Ferraz Shawmut) at 1999, Dr. Zaghlol is leading R&D efforts for new products, development and implementation of R-Tools, on-Line thermal modeling of heatsinks software. He has published and presented technical papers on new product at technical professional conferences. He has authored and coauthored several articles in technical trade show magazines. Dr. Zaghlol, a registered Professional Engineer in Ontario, Canada (PEO).

Short Course 3: Modern Heuristics Algorithms for Automotive Applications

Thursday, June 22nd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in Exhibit Hall)
Venue: Room 307

Instructor: *Dr. Dhafar Al-Ani, Adjunct Assistant Professor, McMaster University*

Course Description: The use of optimization techniques has grown considerably over the past two decades. Over this time, the social models of optimization (also known as modern heuristics or meta-heuristics) have been further enhanced resulting in very simple algorithms with big implications. These algorithms drew the focus of the researchers on the computational intelligence, and particularly, the use and applications of swarm intelligence and evolutionary algorithms paradigm for solving complex optimization problems. For example, swarm algorithms are conceptually derived from the collective and individual intelligence that arises within the swarm and are characteristically more robust and stable than conventional optimization algorithms for many real-world search and optimization problems. Since 1970 (David E. Goldberg - Natural Inspired Genetic Algorithms), powerful heuristic algorithms have been developed in line with increasing power of computers. Promising new concepts that have emerged based on Genetic Algorithm (GA) and Swarm Intelligence (SI) theory. A growing body of researchers in the optimization community is increasingly drawing on GA and SI to tackle hard optimization problems. The reasons behind the rising popularity of such heuristic algorithms are that they offer better searching efficiency (i.e. exploring and exploiting capabilities) for finding the global optimal solution, while providing fast convergence and reduced computational complexity. Hence, Evolutionary Algorithms (EAs) become very demanded techniques to work well for complex optimization problems. This course presents the so-called Modern Historic algorithms to the vehicles' manufacturers and other OEMs. Moreover, the course will address the advantages of modern heuristics as a global search technique to tackle the real-world applications that conventional approaches cannot solve. The most promising future applications directions of heuristic algorithms are aerodynamic design, neural networks design, interactive vehicle design, modern energy storage, SOC estimation, battery aging, parameter identification for battery modeling, design of electric machines, fault detection and diagnostics, vehicle simulation packages, green manufacturing, multidisciplinary design optimization for automobiles industry, new traffic monitoring strategy for intelligent/smart vehicles, and next generation of HEVs (powertrain component, sub-system control).

Instructor's Short Biography:

Dr. Dhafar Al-Ani is currently an Adjunct Assistant Professor in the Electrical and Computer Engineering Department at McMaster University. He holds two Postdoctoral Fellowships in Hybrid Electric Vehicles and Hybrid Technologies, a Doctorate Degree in Mechatronics Engineering, and two Master Degrees in Mechatronics and Mechanical Engineering, with specialization in Multidisciplinary Design Optimization and Optimal Control Strategies. He worked as an Associate Researcher at McMaster Automotive Resource Center (MARC) in the areas of Green Energy, Hybrid Technologies, and Hybrid Electric Vehicles. He had also gained industrial experience in Electrified Powertrain Systems by working with FORD Canada, BMW Germany, and AVL Austria.
Dr. Al-Ani has more than 75 academic published journal articles and conference papers. Also, he has submitted many USA and Canadian patents (in process). Dr. Al-Ani is currently a member in many worldwide engineering organizations and societies such as ASME, IEEE, PEO, AWWA, CSME, OSPE, SAE, and AASCIT.

Industry Special Session – AVL Test Systems, Inc.

TESTING DRIVE INVERTER PERFORMANCE WITH A VIRTUAL E-MOTOR (PHiL)

Thursday, June 22nd, 2017
2:00PM – 3:20PM
Venue: Room 311

Presentation Summary:

Drive inverter testing today can be easily accomplished by use of a virtual e-motor in a Power-Hardware-in-the Loop setup. Core element is a "virtual" e-motor which emulates an e-motor and mimics e-motor characteristics in both, static and highly dynamic drive scenarios. Key to this technology is the precise motor replication, which finally allows to test not only the inverter power capability but also the control performance – without a real motor or mechanics.

A game changer in inverter development: The new testing concept bases on the precise emulation of the electromagnetic motor characteristics while all mechanical behavior is simulated only. It meets the demands of development-related tasks, verification on system level and end-of-line testing. At the same time requirements stipulated by ISO 26262 can be fulfilled. The independence of a real e-motor, a dyno or any other mechanical setup provides an extremely fast method of inverter verification. One tool serves the whole inverter test process as it reliably mimics correct e-motor behavior at all operational points, thus reducing testing effort by more than 90%. Various applications like high power e-drive trains, hybrid configurations or low power applications can take impressive advantage from this testing method.

The workshop will demonstrate a virtual e-motor which replaces the real e-motor in a power steering application. In this setup the motor control electronics (i.e. the unit under test) runs in a closed loop drive simulation configuration with the real electrical (power) interface but without any mechanics involved. In that way detailed motor control electronics testing including fault injection, tolerance scans and dynamic response can be done precisely, reproducibly and in a fast and automated way.

Speaker: *Horst Hammerer, Co-Founder & CEO, SET Power Systems GmbH – Member of the AVL Group*

Horst Hammerer *is Co-Founder & CEO of SET Power Systems GmbH, part of the AVL Group and a leading global supplier of inverter testing systems. He has been involved in aerospace, test systems and power electronics for more than 30 years. Prior to founding his own company, Horst developed and designed new testing strategies at Liebherr-Aerospace. In 2008 he was granted an innovation award for successfully introducing a P-HiL component to test A380 CPCS computers, resulting in a joint venture between his private enterprise and the AVL List GmbH. He is passionate about enhancing and redefining testing methods for more meaningful results, focusing on the transfer of aerospace testing methods to e-mobility. His visions and innovative approaches to technological thinking make him a welcome speaker at conferences and universities. Horst studied in both Germany and the UK and holds a degree in communication engineering from the University of Applied Sciences Ulm. Together with his wife and children he lives in Southern Germany.*

Thursday, June 22, 2017

Afternoon Breakout Sessions

Tutorial 1 – Advanced Magnetic Materials for Your Application

Thursday, June 22nd, 2017
2:00PM – 3:20PM
Venue: Room 308

Instructor: *David Farnia, Arnold Magnetic Technologies*

Tutorial Description: This course will discuss the importance of selecting the appropriate material for the application. We will look at the impact of material selection on transformers as well as permanent magnet machines and discuss ramifications arising from the material selection. We will first cover some basic concepts for electrical steels and permanent magnets. We can then build an understanding of the impact on overall system performance based on these basic material concepts. We will also discuss performance and pricing trends in permanent magnets and thin gauge electrical steels.

Instructor's Short Biography:

David Farnia received a Master's Degree in Electromechanical Engineering from the University of Wisconsin and has spent more than 10 years designing/analyzing electric machines. In this time, David has worked on designs ranging from a 3 Watt computer cooling fan all the way up to a Megawatt hydro-electric generator. David has also worked on soft magnetic material characterization and accurately modeling system performance based on the measured material performance data.

Thursday, June 22, 2017

Afternoon Breakout Sessions

Panel 1: What Software Engineering Fundamentals do Engineers Need to Know for Model Based Development of Embedded Code?

Thursday, June 22nd, 2017

2:00PM – 3:20PM

Venue: Room 302

Panel Organizers and Moderators:

- Mark Lawford, Ph.D., P.Eng., Department of Computing and Software, McMaster University
- Lucian Patcas, Ph.D., Principal Research Engineer, McMaster Institute for Automotive Research and Technology (MacAUTO), McMaster University

Panelists:

- Albert Dunford, Powersim Inc.
- Alan Wassyng, McMaster University
- Tony Lennon, Mathworks, Inc.
- Mark Lawford, McMaster University

Panel Summary:

In model-based development, domain experts, such as electrical, mechanical, and control engineers, create models from which embedded code is generated, despite not having formal software engineering training. Modern Model Based Design (MBD) tools such as Matlab/Simulink and SCADE make code generation from models relatively easy and provide software engineering support tools that help speed development and improve software quality. Given the state of the development tools and the fact that the code is generated from the models, what (if any) fundamental Software Engineering principles do these engineers need to know to successfully design and maintain the models and embedded software? Do principles of design for change, information hiding, modularity, etc. still matter in a model based world? What documentation is still relevant?

Panel 2: Wireless Charging of Electric Vehicles

Thursday, June 22nd, 2017
2.00PM – 3.20PM
Venue: Room 303

Panel Organizer and Moderator:
Veda Galigekere, R&D Staff, Power Electronics and Electric Machinery Group, Oak Ridge National Laboratory

Panelists:
- Steve Ganem, VP, Automotive & Application Engineering, WiTricity
- Ted Bohn, Argonne National Laboratory
- Mustafa Wajid, CEO, Meher Group
- Prof. Khurram Afridi, University of Colorado Boulder

Panel Summary:

Wireless power transfer (WPT) is a convenient, safe, and autonomous means for electric and plug-in hybrid electric vehicle charging that has seen rapid growth in recent years for stationary applications. WPT does not require bulky contacts, plugs, and wires, is not affected by dirt or weather conditions, and is as efficient as conventional charging systems. Recent studies demonstrated wireless charging can reach ~90% end-to-end efficiency levels if designed properly. This panel session covers the insights from leading industry executives and researchers, wireless charging and EV public policy, issues and challenges of vehicle and infrastructure integration, synergies and interactions between roads and vehicles, recent technological advancements, emerging standards, and the broader deployment considerations. Panel discussions will also cover interoperability, vehicle integrations, standards development, and health and safety aspects.

Tutorial 2 – Building Fast and Accurate Powertrain Models for HEV System and Control Development

Thursday, June 22nd, 2017
4:20PM – 5:40PM
Venue: Room 308

Instructor: Kevin Oshiro, Application Engineer, Motor and Power Control, MathWorks Inc.

Tutorial Description: Hardware testing is a necessary step to validate the performance of an electric powertrain. However, it is an expensive way to discover design problems. System simulation is a proven approach to reduce risk in powertrain development in regard to activities such as powertrain architecture studies, component sizing, calibration, and controller testing. For some using system simulation, achieving the proper detail in a model can be a trial and error approach as you try to balance simulation speed and level of accuracy.
In this tutorial, MathWorks Application Engineer Kevin Oshiro will show how simulation libraries provide a starting point and reduce the time it takes to develop a model that produces useful results. The example in this tutorial will cover:

- Developing a powertrain system model
- Using simulation models for systematic design optimization
- Modeling detailed subsystem components such as a nonlinear PMSM motor
- Calibrating an electric motor torque controller.

Instructor's Short Biography:

Kevin Oshiro is currently a member of the MathWorks Pilot Engineering team, where he focuses on enabling Model-Based Design (MBD) for control system development and brings 9 years of expertise in modeling and simulating multi-domain systems for closed-loop controller development. In addition to serving MathWorks commercial customers, Kevin mentors several teams in the EcoCAR3 collegiate competition, where he is helping students to implement MBD to develop control software for their novel HEV powertrains. Prior to MathWorks, he spent 10 years at PACCAR/Kenworth Truck, mostly in the Research and Development group specializing in vehicle simulation and using MBD to develop proprietary Hybrid Electric powertrains for medium and heavy duty trucks. Kevin earned a BSME and BSEE from the Colorado School of Mines, and a MSEE (Controls Theory) from the University of Washington.

Tutorial 3 –Fundamentals for More Electric Aircraft Design

Thursday, June 22nd, 2017
4:20PM – 5:40PM
Venue: Room 302

Instructor: Dr. Tim O'Connell, PC Krause & Associates, Inc.

Tutorial Description: his tutorial is intended for students and professionals in the transportation electrification field who would like to learn more about the fundamental tools and knowledge needed for the design of more electric aircraft (MEA). The material is presented at an introductory level, although a basic working knowledge of electromechanics, physics, and power electronics is assumed. While the concepts presented may be familiar to many in this audience, the application to MEA may be new. Topics covered include the basic design of a dc machine; general MEA electric machine design considerations; MEA-enabling power electronics (design, circuits, devices); and modeling and simulation of large integrated systems. The tutorial will conclude with an example design of an aircraft braking system.

Instructor's Short Biography:

Tim C. O'Connell received the B.A. degree (summa cum laude) in physics from Carleton College, Northfield, MN, in 2003, and the M.S. and Ph.D. degrees in electrical engineering from the University of Illinois at Urbana-Champaign (UIUC), Urbana, in 2005 and 2008, respectively. Since 2009, he has been with PC Krause and Associates (PCKA), West Lafayette, IN, where he is currently a Senior Lead Engineer. He is an Adjunct Research Assistant Professor at UIUC, where he has taught a course on green electric energy technologies since 2012. At PCKA, he is currently leading the multi-member industry modeling and simulation team supporting the design and analysis of more electric aircraft (MEA). He has authored or coauthored more than 20 technical papers and one textbook. His research interests include electromagnetic simulation, and the design, modeling, simulation, and control of power electronics, electric machinery and drive systems.

Dr. O'Connell has served various leadership roles in the IEEE Central Illinois Section since 2015, including Chair, Vice Chair, Treasurer, and Young Professionals Chair. He is currently the Department of Defense Aerospace Industry Liaison to the IEEE Transportation Electrification Community (TEC) and is active in the Society of Automotive Engineers (SAE) Aerospace Electrical Power Systems (AE-7) standards committee. He received the SAE Charles M. Manly Memorial Medal Award for the best paper relating to the theory and design of aerospace engines.

Panel 3: Polyphase Electric Machine Applications for Traction Drive Systems

Thursday, June 22nd, 2017
4:20PM – 5:40PM
Venue: Room 303

Panel Organizer:
Omid Beik, Senior Machines, Drives and Power Electronics Engineer, Magna Powertrain

Panel Moderator:
Berker Bilgin, Program Manager, McMaster Automotive Resource Centre (MARC), McMaster University

Panelists (TBA):
- Lixin Tang, Power Electronics and Electric Machinery Group, Oak Ridge National Laboratory
- Seungdeog Choi, Department of Electrical & Computer Engineering, The University of Akron
- Nigel Schofield, Professor, Huddersfield University, UK
- Zedong Zheng, Department of Electrical Engineering, Tsinghua University

Panel Summary:

Multiphase design for electric machines results in improved torque characteristic and capability in low and extended speed range; it also leads to lower power ratings for the associated power electronic converters and improved DC-link ripples. An important area in the aerospace sector has been improved fault tolerance by recourse to a multiphase design, an area of similar importance for the reliability for electric vehicles. For electric vehicle applications the specification requirements for traction machines include high power density, high efficiency, low mass and wide range of speed operation.

In this panel various aspects of multiphase machines will be discussed:
- What is the main drive for going forward with multiphase design for traction motors
- Benefits of multiphase winding in terms of total power electronics die
- Manufacturing considerations for multiphase windings
- If happens, when and to what capacity will the automotive industry shift to multiphase machine.

Thursday, June 22, 2017

Technical Committee Meeting

Joint PELS/IAS Technical Committee Meeting

Thursday, June 22nd, 2017
7.00PM – 8.15PM
Venue: Room 311

Agenda:

ITEC 2017 Presentation
7.00PM – 7.10PM
ITEC'17 General Chair: Dr. Omer C. Onar, Oak Ridge National Laboratory

IEEE Transactions on Transportation Electrification Presentation
7.10PM – 7.20PM
Editor-in-Chief: Dr. Ali Emadi, McMaster University

IEEE Power Electronics Society (PELS) Technical Committee on Vehicle and Transportation Systems (TC4)
7.20PM-7.30PM
Committee Chair: Dr. Alireza Khaligh, University of Maryland – College Park

IEEE Industry Applications Society (IAS) Transportation Systems Committee
7.30PM-7.40PM
Committee Chair: Burak Ozpineci, Oak Ridge National Laboratory

IEEE Transportation Electrification Community
7.40PM-7.50PM
TEC Chair: Yaobin Chen, Indiana University-Purdue University Indianapolis

ITEC 2018 Presentation
7.50-8.00PM
ITEC'18 General Chair: Dr. Bulent Sarlioglu, University of Wisconsin-Madison

Technical Committee Meeting is open to all conference attendees and will discuss the activities of the PELS and IAS technical committees related to vehicle and transportation systems and ITEC.

Please participate in this joint PELS&IAS meeting if you are interested in getting involved with the IEEE-PELS and/or IEEE-IAS activities including ITEC, workshops, publications, awards, etc.

Friday June 23, 2017

Keynote Presentations

Plenary Session 2
Friday, June 23, 2017
8:30AM – 12.00PM
Venue: Rooms 325-326

Plenary Session Chairs:
Berker Bilgin, McMaster University
Bulent Sarlioglu, University of Wisconsin
Sanjaka Wirasingha, Valeo

Keynote Presentation 1: Bolt to the Future

8.35AM – 9.05AM
Speaker: *Steven Tarnowsky,*
Director, Global Transmission & Electrification, Advanced & New Product Engineering,
General Motors

Short Biography: Mr. Tarnowsky joined General Motors in 1994 where he has worked in areas of propulsion systems, battery charging systems, electrical safety, validation and program management on numerous electric and hybrid-electric vehicle programs including the EV1, eAssist, Chevrolet Volt and Chevrolet Bolt. Prior to joining General Motors, Mr. Tarnowsky was employed by GM Hughes Electronics Corporation. While at Hughes, he spent four years as a systems engineering consultant to General Motors and four years as a systems engineer on the NASA Magellan mission to Venus. Mr. Tarnowsky earned a bachelor's of science degree in electrical engineering from the University of Michigan and a master's of science degree in electrical engineering from the University of Southern California. He is also a licensed Professional Engineer in the state of Michigan.

Keynote Presentation 2: Sometimes Physics Gets in the Way of the More Electric Aircraft

9.05AM – 9.35AM
Speaker: *Nicholas J. Nagel, Ph.D.,*
Director, Research & Development,
Triumph Aerospace Systems - Seattle

Short Biography: Nicholas J. Nagel received a B.S. degree in mechanical engineering from the University of Illinois – Champaign/Urbana in 1989. He received the M.S. degrees in mechanical and electrical and computer engineering and Ph.D. degree in mechanical engineering from the University of Wisconsin – Madison in 1995, 1996, and 1998, respectively, with a focus in control of electric machinery. His Ph.D. thesis was on modeling and control of switched reluctance machines. He is currently employed at Triumph Aerospace systems – Seattle, Washington, where his research is focused on high performance motion and motor control for aerospace applications. Dr. Nagel is also an affiliate professor at the University of Washington where he teaches courses in Electric Machines and Drives, Controls, and Power Electronics.

Friday June 23, 2017

Keynote Presentations

Keynote Presentation 3: Automotive Tier-1: Life in the Middle

9.35AM – 10.05AM

Speaker: *Richard Hampo*
Senior Director of Engineering and Traction Inverters, Delta Products Corporation

Short Biography: Richard Hampo is the senior director of engineering - traction inverters at Delta Products Corporation. He has been developing automotive power electronics for over 25 years. After earning BSEE and MSEE degrees from the University of Michigan Ann Arbor, he joined Ford Research Laboratory where he worked on the first generations of systems for electrified vehicles. After earning his MBA, also from UM Ann Arbor, he moved to Ecostar Electric Drive Systems, where he was the manager of the electrical engineering team. With his team, he developed several generations of integrated drive systems (Inverter + motor + gearbox + DCDC) for 2 OEM's fuel cell vehicle programs. In 2008 he joined Lear Corporation and helped grow the high power business from its initiation. He was responsible for the team that developed, from concept through to production, on-board chargers, wireless vehicle chargers, traction inverters, DCDC converters, and AC inverters for OEM customers around the world. Recently he accepted a position at Delta Electronics Corporation and is building a group that will design and develop traction inverters for the automotive industry. He currently holds 45 US patents.

Coffee Break, 10.05AM – 10.30AM

Keynote Presentation 4: Powertrain Controls in Modern EVs

10.30AM – 11.00AM

Speaker: *Silva Hiti,*
Senior Director of Powertrain Engineering, Faraday Future

Short Biography: Silva Hiti holds a PhD degree in Power Electronics from Virginia Tech. From 1995 to 2014, she was with Hughes and General Motors Advanced Technology Center (ATC) in Torrance, California where she worked on electrification of GM's vehicles. She was a Technical Fellow of GM, and led development of power conversion control algorithms for electric drives used in GM's electric and hybrid-electric vehicles including EV1 and Chevy Volt. She is the co-author of more than 90 US patents. Since September 2014, she has been with Faraday Future, a start-up company aimed at developing fully-electric vehicles offering smart and seamless connectivity to the outside world. She is currently Senior Director for Powertrain Engineering, and leads the development of the drive unit, power electronics, and powertrain embedded controls and software.

Friday June 23, 2017

Keynote Presentations

Keynote Presentation 5: Enabling the More/All Electric Aircraft

11.00AM – 11.30AM

Speaker: *John Nairus,*
Chief Engineer, Power & Control Division,
The Air Force Research Laboratory

Short Biography: John began his career with the Air Force Research Laboratory's Aerospace Systems Directorate in 1987 serving in various capacities beginning as research engineer and program manager in the area of power electronics and aircraft electrical power systems for the Power Division's Electrical Technology Branch in support of the More Electric Aircraft Initiative. John also served as chief of the Mechanical Energy Conversion and Thermal & Electrochemical Branches before becoming the Power & Control Division's Chief Engineer. He also continues to serve as an Electrical Power and Thermal Management Subject Matter Expert in the Joint Strike Fighter Program Office. John earned his Bachelor and Master's Degrees in Electrical Engineering from the University of Dayton, is a registered Professional Engineer in the State of Ohio, and an AIAA Associate Fellow. John also recently led the Interagency Advanced Power Group (IAPG) and served on the National Academies Low Carbon Aviation Committee. Today, John Chairs OSD's Energy and Power Community of Interest as well as the AIAA's Energy Optimized Aircraft and Equipment Systems Program

Keynote Presentation 6: 48v Mild Hybrid Vehicle System
11:30 AM – 12:00 PM

Speaker: *Matti Vint*
Engineering R&D Director
Valeo

Short Biography: Dr. Matti Vint is the Engineering R&D Director for Powertrain Systems at Valeo, responsible for the powertrain business group for North America. His responsibilities include product marketing, regulations, systems integration and R&D activities, covering combustion engine and electrified powertrain systems.

Dr. Vint has more than 25 years automotive experience, focused primarily on powertrain and hybrid vehicle systems, with extensive experience covering systems integration, product development, software controls, calibration and vehicle & engine testing. He has also been awarded 12 patents and one Trade Secret. He has worked in a variety of technical specialist and engineering management roles for a diverse range of automotive organizations providing him a broader perspective, with his experience spanning OEMs (Ford North America and Ford Australia), Tier 1 suppliers (Visteon and Valeo), engineering services (Ricardo) and University research (Energy Systems Research Group at the University of Queensland, Australia).

Friday, June 23, 2017

Poster Session 2

Friday June 23rd, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chair: Woonki Na

Paper ID	Title/Author
1120	**Algorithm for Prediction and Control of Induction Motor Stator InterTurn Faults in Electric Vehicles,** *Jaya Sai Praneeth A V. University of Ontario Institute of Technology*
1131	**Loss Minimizing Gear Shifting Algorithm Based on Optimal Current Sets for IPMSM,** *Taeyeon Lee, Yoonjae Kim, Kwanghee Nam, Pohang University of Science and Technology*
1139	**Novel Design of Multistage Integrated Motor-Compressor,** *Hao Ding, Yingjie Li, Mingda Liu, Bulent Sarlioglu, University of Wisconsin-Madison*
1140	**Design and Control of an Interleaved Bi-Directional Power Converter for Railway Applications,** *Woonki Na, California State University, Fresno, Min-Keuk Kim, Kdsystek Co., Ltd., Joonghoon Kim, Chung-Nam University, Pengyuan Chen, California State University, Fresno, Edward D. Choi, LG Electronics USA*
1143	**Operating Mode Transition Control of a SiC Integrated DC DC Powertrain Charger for Electric Vehicles,** *Saeed Anwar, Daniel Costinett, University of Tennessee, Knoxville*
1149	**Power Analysis of a Single Degree of Freedom (DOF) Vibration Energy Harvesting System Considering Controlled Linear Electric Machines,** *Jin Ye, Zhequ Lu, Cheng Chen, San Francisco State University, Mengqi Wang, University of Michigan-Dearborn*
1154	**Uncertainty Analysis and Propagation for an Auxiliary Power Module,** *Vipin Kumar Kukkala, Thomas H. Bradley, Sudeep Pasricha, Colorado State University*
1155	**Research on Interaction Between Continuous Commutation Failure of UHVDC and AC System Fault,** *Peng Wei, Qian Zhou, Jian-Kun Liu, Jiangsu Electric Power Research Institute*

Friday, June 23, 2017

Poster Session 2

Friday June 23rd, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chair: Woonki Na

Paper ID	Title/Author
1165	**Mitigating Impacts of Plug-in Electric Vehicles on Local Distribution Feeders Using a Charging Management System,** *Alejandro Carrillo, Armando Pimentel, Eliza Ramirez, Ha Le, California State Polytechnic University, Pomona*
1166	**Comparative Analysis of Conventional Switched Reluctance Machines and Mutually Coupled Switched Reluctance Machines,** *Forest Hensley, Aik Wah Wong, Wei Chung Yu, Jin Ye, San Francisco State University*
1168	**Ambient Temperature Impacts on Real-World Electric Vehicle Efficiency & Range,** *John Taggart, Stanford University*
1174	**An Improved Totem-Pole Bridgeless Power Factor Corrector with Complementary Driving Signals,** *Zhuoran Liu, Haiping Xu, Zuzhi Zhang, Institute of Electrical Engineering, Chinese Academy of Sciences*
1175	**Third Harmonic Input Current Cancellation Strategy for Single-Phase Power Factor Correction with Non-Electrolytic Capacitors,** *Zhuoran Liu, Haiping Xu, Cong Xiong, Zuzhi Zhang, Institute of Electrical Engineering, Chinese Academy of Sciences*
1180	**Reviews on Grid-Connected Inverter, Utility-Scaled Battery Energy Storage System, and Vehicle-to-Grid Application – Challenges and Opportunities,** *Wooyoung Choi, Yujiang Wu, Di Han, Joseph Gorman, Pablo Castro Palavicino, Woongkul Lee, Bulent Sarlioglu, University of Wisconsin-Madison*
1182	**D- and Q-Axis Inductance Calculation of IPMSM Using Approximate Analytical Model,** *Hilmi Gurleyen, Pablo Castro Palavicino, University of Wisconsin-Madison, Erkan Mese, Ege University, Bulent Sarlioglu, University of Wisconsin-Madison*
1185	**An Integrated Boost Three-Level Full-Bridge Converter,** *Zhilei Yao, Jing Xu, Yancheng Institute of Technology,*

Friday, June 23, 2017

Poster Session 2

Friday June 23rd, 2017
12:00 PM – 2:00 PM
Exhibit Hall, Lakeview Terrace
Session Chair: Woonki Na

Paper ID	Title/Author
1186	**Inductor Design for Multiphase Bidirectional DC-DC Boost Converter for an EV/HEV Application,** *Dave Schumacher, Berker Bilgin, Ali Emadi, McMaster University*
1189	**Feasibility Study of Hybrid Inductive and Capacitive Wireless Power Transfer for Future Transportation,** *Deepa Vincent, Phuoc Huynh Sang, Sheldon S. Williamson, University of Ontario Institute of Technology*
1192	**A Review of High-Power Wireless Power Transfer,** *Andrew Foote, Omer C. Onar, Oak Ridge National Laboratory*
1196	**Investigation of Electromagnetic Noise on Pole and Slot Number Combinations with Possible Fractional-Slot Concentrated Windings,** *Seun Guy Min, Bulent Sarlioglu, University of Wisconsin-Madison*
1197	**Analytical Solution of Electromagnetic Noise Caused by Radial Force and Torque Variation in Fractional-Slot PM Motors with All Teeth Wound,** *Seun Guy Min, Bulent Sarlioglu, University of Wisconsin-Madison*
1115	**Fault-Tolerant Control of Multiphase Induction Machine Drives Based on Virtual Winding Method,** *Zhong Peng, Zedong Zheng, Yongdong Li, Tsinghua University, Zicheng Liu, Beijing Jiaotong University*

Short Course 4: Fundamentals and Practical Design of Traction Inverters for Hybrid Electric Vehicles

Friday, June 23rd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in Exhibit Hall)
Venue: Room 305

Instructors:

- *Dr. Lihua Chen and Yan Zhou, HEV inverter Core Eng. Technical Experts, Ford Motor Co.*
- *Dr. Jin Wang, Ohio State University*
- *Dr. Mark J. Scott, Miami University*

Course Description: This educational short course is focused on introducing power electronics system and traction inverter design for hybrid electric vehicles. Many practical aspects and challenges will also be specifically addressed. In the course, the fundamentals of traction inverter hardware design are introduced, and the High Voltage (HV) and Low Voltage (LV) key component sizing will be intensively addressed. In order to help the audience's better understanding, many benchmarking comparisons and design examples will be included with technical detail explanations. A specific approach, developed at automotive OEM industry, to derive the electric drive system requirements and inverter specifications from customer drive patterns and/or usage profiles, will be introduced. Application focused system level optimization and trade-off design methods will also be discussed. Some vehicle operation related extreme conditions and worst case scenarios, which usually challenge hardware design, will be addressed in order to explain automotive related harsh conditions and stringent requirements. Also, this short course will introduce advanced new power device such SiC and GaN technologies and their promising applications in the power electronics system of next generation electrified vehicles. The intent of this educational short course is to introduce the power electronics system for electrified vehicle applications from a practical point of view. It is dedicated to help the audience better understanding traction inverter design aspects to meet automotive application requirements. It should also be of interest to engineers who work on power electronics system for various transportation electrifications.

Instructors' Short Biographies:

Lihua Chen received his Ph.D. degree from Michigan State University. He joined Ford Motor Company in 2008 and currently works as a Power Electronics Technical Expert technically leading traction inverter design for Ford next generation hybrid electric vehicles. From 1999 to 2002, he was with Argonne National Lab, Chicago, as a Visiting Researcher, and before that, he has worked as an Assistant Professor for three and one half years in China. He has authored 100+ technical papers and holds more than 10 US, Europe and China patents. He also has given numerous technical presentations to IEEE conferences, research institutes, universities and various companies.

Jin Wang received a B.S. degree from Xi'an Jiaotong University, in 1998, an M.S. degree from Wuhan University, in 2001, and a Ph.D. from Michigan State University, East Lansing, in 2005, all in electrical engineering. From Sept., 2005 to Aug. 2007, he worked at the Ford Motor Company as a Core Power Electronics Engineer and contributed to the traction drive design of the Ford Fusion Hybrid. He joined the Department of Electrical and Computer Engineering at The Ohio State University as an assistant professor in September 2007 and was promoted to associate professor in September 2013. His research interests include wide bandgap power devices and their applications, high-voltage and high-power converter/inverters, integration of renewable energy sources, and electrification of transportation. Dr. Wang received multiple teaching and research awards including the IEEE Power Electronics Society Richard M. Bass Young Engineer Award and the National Science Foundation's CAREER Award, both in 2011; Ralph L. Boyer Award for Excellence in Undergraduate Teaching Innovation from the College of Engineering at The Ohio State University in 2012, and the Lumley Research Award of the College of Engineering at The Ohio State University in 2013. Dr. Wang has over 100 peer-reviewed journal and conference publications and three patents. Dr. Wang had been an Associate Editor for IEEE Transactions on Industry Applications from 2008 to 2014. He initiated and served as the General Chair for the 1st IEEE Workshop on Wide Bandgap Power Devices and Applications in 2013. Currently, Dr. Wang serves as an Associate Editor for IEEE Transactions on Power Electronics and IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE).

Yan Zhou received the B.S. and M.S. degrees from Huazhong University of Science and Technology, Wuhan, China, in 2007 and 2009, respectively, and the Ph.D. degree from Florida State University, Tallahassee, FL, in 2013, all in electrical engineering. He is currently with Ford Motor Company, Dearborn, MI, as a Power Electronics Core Engineer for hybrid electric vehicle (HEV) development. His research interests include Hybrid Vehicle Traction inverter development, power conversion for distributed energy sources, intelligent gate drive for high power devices, and WBG devices.

Mark J. Scott (S'09, M'16) received his B.S. (2005), M.S. (2013) and Ph.D. (2015) degrees from The Ohio State University. His dissertation topic utilized wide bandgap (WBG) power devices in converters and multilevel inverters based on switched-capacitor cells. Between his undergraduate and graduate degrees, he worked in industrial automation and as a test engineer validating power electronics designed for vehicles. Dr. Scott is an assistant professor at Miami University in Oxford, OH. His research focuses on improving the efficiency and increasing the reliability of power electronic hardware. He is studying the benefits of using silicon carbide (SiC) and gallium nitride (GaN) power devices in electrified transportation and solar power systems. He is a member of IEEE. He also serves as the faculty advisor for the IEEE Student Organization at Miami University and Miami University's Renewable Energy Club.

Short Course 5 – Tool Support for Model Based Software Engineering in MATLAB/Simulink for Domain Experts

Friday, June 23rd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in Exhibit Hall)
Venue: Room 306

Instructors:

- *Dr. Mark Lawford, Ph.D., P.Eng., Dept. of Computing and Software, McMaster University*
- *Dr. Lucian Patcas, Ph.D., Principal Research Engineer, McMaster Institute for Automotive Research and Technology (MacAUTO), McMaster University*
- *Dr. Alan Wassyng, Associate Professor, Dept. of Computing and Software McMaster University*
- *Dr. Vera Pantelic, McMaster University*
- *Monika Jaskolka, Alexander Schaap, Bennett Mackenzie, Gordon Marks, McMaster University*

Course Description: In model-based development, domain experts, such as electrical, mechanical, or control engineers, despite not having formal software engineering training, often find themselves creating models from which embedded code is generated, therefore contributing to the design and coding activities of software development. This course is aimed at improving design with Simulink from the software engineering perspective, by developing automated support for the application of some traditional software engineering principles when developing with Simulink. We present a number of open source tools which we developed at McMaster University in Canada: The Signature Tool, the Reach/Coreach Tool, the Data Store Rescope Tool, and the Auto Layout Tool. The Signature Tool extracts the interface of a Simulink subsystem, enabling developers to better understand the implicit data ow in Simulink models and use it more effectively, while also producing useful documentation and improving testing coverage. The Data Store Rescope Tool improves modularity of Simulink models by properly scoping data stores, helping to meet modeling guidelines. The Reach/Coreach Tool highlights data and control dependencies and extracts the relevant part of a Simulink model, making it easier to understand and perform dependency analysis. Also, the tool supports debugging, reverse-engineering, refactoring, and static analysis of the models. The Auto Layout Tool significantly improves the layout of Simulink models, reducing the large effort developers invest in adjusting layout to improve the readability of their models and comply with modeling guidelines. Finally, we show how these tools can be combined with Simulink Report Generator to automatically generate improved system design documentation, providing a customizable documentation template that participants can use as the basis for generating their own system design description documentation. The intended audience of this course is domain experts involved in the development of software intensive systems, but also software practitioners and managers involved in software and/or software development with Simulink.

Instructors' Short Biographies:

Mark *Lawford* *is a Professor in McMaster University's Department of Computing and Software and the Associate Director of the McMaster* Centre for Software Certification. He is a licensed Professional Engineer in the province of Ontario and a Senior Member of the IEEE. He received his PhD in 1997 from the Systems Control Group in Electrical and Computer Engineering at the University of Toronto and then worked at Ontario Hydro as a real-time software verification consultant on the Darlington Nuclear Generating Station Shutdown Systems Redesign project, receiving the Ontario Hydro New Technology Award for Automation of Systematic Design Verification of Safety Critical Software in 1999. He joined McMaster University's Department of Computing and Software in 1998 where he helped to develop the Software Engineering programs and Mechatronics Engineering programs. He served as the Section Chair for Computer Systems on the Computer Science Evaluation Group for the 2010 NSERC Discovery Grant Competition. From 2006 to 2007, he was a Senior Researcher in the Software Quality Research Lab at the University of Limerick, Ireland, and in August 2010, he was a visiting researcher at the Center for Devices and Radiological Health, Office of Science and Engineering Laboratories of the US FDA. His research interests include software certification, application of formal methods to safety critical real-time systems, supervisory control of discrete event systems, and cyber physical systems.

Alan Wassyng has been working on safety-critical software-intensive systems for more than 25 years, and is licensed as a Professional Engineer in Ontario. After spending 14 years as an academic, he consulted independently on critical software development for more than 15 years. He helped Ontario Hydro (OH) develop methods for safety-critical systems, and was a key member of the team that designed the methodology and built the software for the shutdown systems for the Darlington Nuclear Station. In 1995 he was awarded an OH New Technology Award for "Development of Safety-Critical Software Engineering Technology." In 2002 he returned to academia. He publishes on software certification, and the development of safe and dependable software-intensive systems, primarily in automotive, medical devices, and nuclear power. He was a co-founder of the McMaster Centre for Software Certification, and was its inaugural Director. He is a cofounder of the Software Certification Consortium (SCC), and has served as Chair of the SCC Steering Committee since its inception in 2007. He has consulted for the US Nuclear Regulatory Commission, and in July 2011, he was a visiting researcher in the Center for Devices and Radiological Health at the US Federal Drug Administration. In 2012 he was invited to give a keynote talk at Formal Methods (the premier conference in the field), and a keynote at FormaliSE 2013. In 2006 he was awarded the McMaster Students Union Award for Teaching Excellence in the Faculty of Engineering. He has served as a PI or co-PI on a number of funded projects at McMaster University.

Vera Pantelic received a B.Eng. in Electrical Engineering from the University of Belgrade, Belgrade, Serbia, in 2001, and a M.A.Sc. and a Ph.D. in Software Engineering from McMaster University, Hamilton, ON, Canada, in 2005 and 2011, respectively. She is working as a Principal Research Engineer with the McMaster Centre for Software Certification, and McMaster Institute for Automotive Research and Technology (MacAUTO), McMaster University. Her research interests include development and certification of safety-critical software systems, model-based design, and supervisory control of discrete event systems..

Lucian Patcas is a Principal Research Engineer with the McMaster Centre for Software Certification (McSCert) and McMaster Institute for Automotive Research and Technology (MacAUTO) at McMaster University in Hamilton, ON, Canada. His main research interests fall in the area of formal methods for real-time and safety-critical software. Currently, he is involved in several research projects related to the safety of automotive software, simulation and analysis of CAN networks, and model-based development of automotive software. Dr. Patcas was previously a Postdoctoral Fellow in the Department of Computing and Software at McMaster University. He received a Ph.D. in Software Engineering from McMaster University in 2014, a Master's in Computer Science from University College Dublin, Ireland in 2007, and a Bachelor's in Software Engineering from Politehnica University of Timisoara, Romania in 2004.

Monika Jaskolka is a Ph.D. student in Software Engineering at McMaster University, Hamilton, ON, Canada. She received a Master's degree in Software Engineering from McMaster University in 2014, and an Honours Bachelor of Computer Science degree in 2012 from Laurentian University, Sudbury, ON, Canada. Monika currently holds an NSERC Alexander Graham Bell Canada Graduate Scholarship - Doctoral (CGS D). Her main research interests include model-based development, safety-critical systems, and software engineering design principles.

Alexander Schaap is a Ph.D. student in Software Engineering at McMaster University in Hamilton, ON, Canada. He received his Master's in Software Engineering at McMaster in 2016, and his Bachelor's degree in Computer Science in the Netherlands in 2013. Alex's research interests include the application of generative programming techniques and functional programming languages, but also proper software engineering as a whole.

Bennett Mackenzie is a Master's student in Software Engineering at McMaster University, ON, Canada and completed his Bachelor of Engineering in Software Engineering in 2016 at McMaster. His research interests include Software Engineering principles in Model-Based Design and tool-support for Model-Based Design.

Gordon Marks completed his Bachelor of Engineering and Management in Software Engineering in April 2017 at McMaster University in Hamilton, ON, Canada, and will begin as a Master's student at McMaster in September 2017. His main research interests include model-based development, and software engineering design principles.

Mark, Alan, Vera, Lucian, Monika, Alexander, Bennett, and Gordon are part of the Automotive Partnership Canada (APC) project entitled Next Generation Affordable Electrified Powertrains with Superior Energy Efficiency and Performance -- Leadership in Automotive Powertrain (LEAP), a multi-million dollar, multidisciplinary collaboration between McMaster University and a major automotive OEM for the development of next generation hybrid-electric powertrains.

Tutorial 4 –Fundamentals of Battery Electrochemistry and Control of Electric Vehicle Batteries

Friday, June 23rd, 2017
2:00PM – 3:20PM
Venue: Room 307

Instructors: Dr. Vishal Mahajan, Samsung and Dr. Ryan Ahmed, Adjunct Assistant Professor, McMaster University

Tutorial Description: This course is divided into two sections: (1) Fundamentals of Battery Electrochemistry and (2) Control of Electric Vehicle Batteries.

Section (1): covers the fundamentals of Lithium-Ion battery electrochemistry and the relationship between chemical effects and electrical performance. Topics include design of lithium-Ion cells, cells working principals, electrochemical characterization and performance evaluation. The design of lithium-Ion cells section focuses on materials and components, various types of cells and their applications in the automotive industry. Cells working principles section covers advanced concepts of battery electrochemistry as well as new advancements in Lithium-Ion batteries. Electro-chemical characterization and evaluation topic includes electrochemical performance and abuse testing for both U.S. and international standards used to standardize test protocols. Section (1) of the course is designed to provide students with basic understanding of Lithium-Ion batteries and prepare them for section (2) which includes advanced concepts in control strategies for lithium ion cells and battery packs.

Section (2): covers the principals of Battery Management Systems (BMS) for monitoring, diagnosis, and control of batteries in Hybrid Electric Vehicles (HEVs) and Battery Electric Vehicles (BEVs). The course is targeted towards systems engineers, research scientists, and academics who want to gain a fundamental understanding of battery modeling, analysis, state-of-charge, and state-of-health estimation. Topics include introduction to battery systems, battery equivalent circuit-based modeling, battery electrochemical modeling, state-of-charge, and state-of-health estimation. Concepts such as parameters estimation, optimization, filtering, and control theory will be applied to battery systems. The techniques covered in this course are mostly related to Li-ion cells and packs as used in automotive applications

Instructors' Short Biographies:

Vishal Mahajan is a battery technology expert at Samsung SDI North America. He holds M.S. and Ph.D. degrees in Materials Engineering from the University of Nevada Reno. Dr. Mahajan has extensive experience in Lithium-Ion cells design, development and testing. His current research focuses on understanding the controlled drive cycle performance of lithium ion cell in a battery pack to predict the target performance of electric vehicles in the field. Before joining Samsung SDI, Dr. Mahajan worked as a research manager at XALT Energy where he developed high energy density cathode materials and lithium ion cells for several automotive applications. He was also a team member of EV innovations Inc. which designed the X-Prize award winning EV Wave-II. Dr. Mahajan has 8 years of experience in green energy technologies and lithium ion batteries. He has authored 19 peer reviewed papers and 3 patent disclosures in the green energy and battery technology.

Ryan Ahmed is an adjunct professor at McMaster University and Co-Chair at the 2017 IEEE Transportation Electrification Conference (ITEC). Dr. Ryan holds a doctorate degree in Mechanical Engineering, with focus on Mechatronics and Electric Vehicle Controls from McMaster University. He received a Master's degree in Mechanical Engineering from McMaster, with specialization in artificial intelligence and engine fault detection. Dr. Ryan held different engineering positions in both industrial and academic settings. Most recently, he worked as a xEV Systems Engineering Lead at Samsung Inc. in Michigan, USA and as a Senior Scientific Research and Experimental Development Technical Specialist at Fiat-Chrysler Automobiles (FCA). Dr. Ryan has authored over 20 peer-reviewed journal and conference papers in the area of hybrid vehicles control, engine management and fault detection, battery state-of-charge and state-of-health estimation, and battery monitoring and control. Dr. Ryan has taught several courses on management and control of electric vehicles at McMaster University and at the educational EV/HEV boot camp at the IEEE Transportation Electrification Conference and Expo (ITEC 2015) in MI, USA. Dr. Ryan was the co-recipient of the best paper award at the IEEE Transportation Electrification Conference and Expo (ITEC 2012) in Detroit, MI, USA. He is a Stanford Certified Project Manager (SCPM), certified Professional Engineer (P.Eng.) in Ontario, a member of the Green Auto Powertrain (GAPT) research team, a member of the Society of Automotive Engineers (SAE), and a member of the Institute of Electrical and Electronics Engineers (IEEE).

Panel 4 –The Future of Self-Driving Vehicles - Autonomous Driving Technical Insights

Friday, June 23rd, 2017

2.00PM – 3.20PM

Venue: Room 302

Panel Organizers and Moderators:

- Haochi Li, Feilong Liu (Autonomous Driving Sub-System Lead), and Xiang Shou, General Motors

Panelists:

- Wende Zhang, Technical Specialist on BFO of Viewing Systems, Automated Driving & Active Safety Viewing, General Motors
- LaMont McAliley, Senior Principal Systems Engineer, Noblis, Inc.
- Walton Fehr, Principal Technical Advisor, Technology and Innovation Policy Division, National Transportation Systems Center, U.S. Department of Transportation
- Dominic Karbowski, Technical Manager, Intelligent Eco-Mobility, Systems Modeling and Control, Argonne National Laboratory

Panel Summary:

The development of autonomous driving technology and deployment connected transportation system that makes the most of multi-modal, transformational applications require a robust, underlying technological platform. The platform is a combination of well-defined technologies and interfaces to minimize the risk and maximize opportunities through processes for safe, stable, interoperable, and reliable system operations. The technical iteration on vehicle perception and path planning drives innovations on advanced controls strategies with inputs of GPS guidance and on board sensors such as cameras, sensors, radar/lidar, and etc. Highly precise and dynamic maps have been identified as a key element to take the "machine nature" out of self-driving vehicles and as a critical asset to understand upcoming road conditions, enabling proactive rather than reactive driving strategies. The applications on connected vehicles are also designed to increase situational awareness and reduce or eliminate crashes through vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) data transmission that supports: driver advisories, driver warnings, and vehicle and/or infrastructure controls. These technologies may potentially address a great majority of crash scenarios with unimpaired drivers, preventing tens of thousands of automobile crashes every year. The significant data processing involved in autonomous driving and V2V/V2I communications requires resiliency and immunity for cyber security issues. This panel session will discuss technology, applications, dedicated short range communications (DSRC) technology and capabilities, policy and institutional issues, and international research on the subject matter.

Panel 5 –High Voltage Components and ePT Architectures for PHEV, HEV, and EV Applications

Friday, June 23rd, 2017

2:00PM – 3:20PM

Venue: Room 303

Panel Organizer and Moderator:

- Dhafar Al-Ani, Adjunct Assistant Professor, McMaster University

Panelists:

- Elie Naim, Technical Specialist – Electrification, AVL Test Systems, Inc.
- Sriram Jala, Design and Release Engineer, Ford Motor Company
- Geng Niu, Karma Automotive

Panel Summary:

Although hybrid vehicle technology is in its infancy, it is a rapidly evolving industry. All vehicle manufacturers are developing hybrids, and hybrid technology represents a stepping-stone to advance electric propulsions. Hybrid vehicles first used the concept of low-rated power of electric components (i.e., low-voltage circuits). However, today's trend deviates towards a new path of using high-voltage systems to gain the benefit of implementing features and functions such as power-looping, high torque and power, and start/stop technologies. Although panels such as this can only supplement OEM and hybrid industry with brief information, the goal of this session is to highlight and review the best practices regarding the pros and cons of both E/E architecture, low and high voltage systems, in terms of rigorous power requirements, robust component performance, and additional safety features due to the challenging environment. Furthermore, the panelists will discuss several topics related to the design and development, testing and safety, the road maps for future applications, and finally the feasibility of solutions for cheaper and energy-efficient applications, which play a powerful role in helping to reduce emissions.

Tutorial 5 –Power Line Communications for Vehicular and Smart Grid Applications

Friday, June 23rd, 2017
4:20PM – 5:40PM
Venue: Room 307

Instructors: Dr. Andrea M. Tonello, Prof. Dr. Ing., Institute of Networked and Embedded Systems, Alpen-Adria-Universitaet Klagenfurt

Tutorial Description: The evolution of the electrical grid into the Smart Grid (SG) and the transition to electrical vehicles requires a telecommunication infrastructure and advanced communication technologies that offer reliable data connectivity. Power lines provide a medium through which data signals can be conveyed exploiting the Power Line Communication (PLC) technology. Applications of PLC are many: from home/industrial networking, to smart grid, to in-vehicle (IV) data buses, and vehicle-to-grid (V2G) integration. However, the power line channel is a hostile medium that poses several challenges so that appropriate communications and signal processing solutions have to be devised. This tutorial will focus on SG PLC, IV PLC, V2G PLC and backhauling PLC to connect, for instance, charging stations or road side wireless base stations to the core network. It will provide an overview of the communication medium characteristics, the state-of-the-art physical layer and signal processing techniques, the protocols/standards, and the performance analysis. The role of PLC in the context of other wireline and wireless solutions, e.g., LIN/CAN buses, wireless sensor networks, wireless IoT, will also be discussed to show that hybrid wireless/PLC approaches are of great importance.

Instructor's Short Biographies:

Andrea Tonello is Professor and Chair of the Embedded Communication Systems Group at the University of Klagenfurt, Austria. He received the Laurea degree (summa cum laude, 1996) and the Ph.D (2002) in electrical engineering from the University of Padova. From 1997 to 2002, he was with Bell Labs-Lucent Technologies, Whippany, NJ, USA, first as a Member of the Technical Staff. Then, he was promoted to Technical Manager and appointed to Managing Director of the Bell Labs Italy division. From 2003 to 2014 he was Aggregate Professor, and later Associate Professor, with the University of Udine, Italy where he founded the Wireless and Power Line Communications Lab and the spin-of company WiTiKee. Dr. Tonello received several awards, including eight best paper awards, the Bell Labs Recognition of Excellence Award (1999), the Distinguished Visiting Fellowship from the Royal Academy of Engineering, U.K. (2010), and the IEEE VTS Distinguished Lecturer Award (2011-2015). He serves as Chair of the IEEE Communications Society Technical Committee on Power Line Communications. He is Distinguished Speaker of IEEE VTS and Associate Editor of IEEE Trans. on Communications and IEEE Access. He was the General Chair of IEEE ISPLC 2011, IEEE SmartGridComm 2014 and of the Workshop on Power Line Communications 2009 and 2015. He is TPC Co-Chair of IEEE SmartGridComm 2017. Web: www.andreatonello.com

Panel 6: More Electric Aircraft Applications

Friday, June 23rd, 2017

4.20PM – 5.40PM

Venue: Room 302

Panel Organizer and Moderator:

Tim O'Connell, Senior Lead Engineer, PC Krause and Associates (PCKA)

Panelists:

- Art Schuetze, Power Systems Engineer, Lockheed Martin Aeronautics
- Mike Weyant, Electrical Power Generation and Distribution Systems Engineer, U.S. Air Force (Retired)
- John Nairus, Chief Engineer, Power and Control Division, Air Force Research Laboratory (AFRL)
- Bulent Sarlioglu, University of Wisconsin – Madison (formerly with Honeywell Aerospace)

Panel Summary:

The rapid advancement of power electronics in the 1970's and 1980's spurred the U.S. Air Force to explore what advantages, if any, could be realized by replacing the traditionally hydraulic, electric, pneumatic, and/or mechanical aircraft systems with electrically-powered versions. Thus, the "more electric aircraft" (MEA) concept was born. Numerous subsequent studies demonstrated that MEA technologies could lead to reductions in logistics and ground support equipment, and substantial improvements in reliability, maintainability, survivability, costs, environmental impact, and performance. Many MEA concepts from the early '80's have become reality today. For example, the F-35 Joint Strike Fighter (JSF) is dependent on many MEA concepts from the late 90's, and both the C-141 transport aircraft and the F-18 fighter utilize electric actuators. MEA concepts have even made their way into commercial aviation, as is evident in the Boeing 787 Dreamliner, which has replaced most systems that are traditionally bleed-air pneumatically powered with electric-powered versions. Key technologies relevant to the ITEC community have paved the way for these advances: high-power motor drives, semiconductor power switches, and electric machines are three of the clearest examples.

In this panel, we have assembled experts from all levels of MEA development – suppliers, airframers, and the Air Force – with close to 100 years of combined experience in this field. The panelists will briefly highlight their experiences and reflect on how far the MEA concept has progressed since its early days until today. They will also discuss the remaining "big" challenges that must be overcome in order to realize MEA designs on a large scale, and how the ITEC community can play an important role in this.

Panel 7 –Electric Motor Whine, NVH – Challenges and Solutions

Friday, June 23rd, 2017
4:20PM – 5:40PM
Venue: Room 303

Panel Organizers:
Beijing Wang and Anand Sathyan, FCA US LLC

Panel Moderator:
Hossein Dadkhah, FCA US LLC

Panelists:
- Babak Fahimi, University of Texas at Dallas
- Rakib Islam, Nexteer Automotive
- Rocky Khurana – FCA US LLC

Panel Summary:

The influx of different hybrid and electric vehicle configurations has brought about unique NVH (Noise, Vibration and Harshness) challenges from a variety of sources. Usually NVH issues are detected late in program development, and once the vehicle environment is more mature, this makes the resolution process to be very difficult. So NVH is recognized as one of the major problems currently faced by automotive manufacturers and their suppliers and hence, need the ability to predict potential problems and identify solutions during the design phase before millions of dollars have been spent in design, prototyping, and manufacturing tooling.

This panel introduces participants to basic traction motor NVH principles and unique NVH challenges encountered in the development of HEV, PHEV, ReEV and EV vehicles. This panel will also introduce the audience to key NVH issues specific to motors used in electrified vehicles (i.e Permanent Magnet Motors, Induction Motors and Switched Reluctance Motors) and means to develop appropriate countermeasures to reduce NVH. Identify key metrics available to access the NVH performance of electrified vehicles and develop an awareness of advanced NVH methodologies available to design the sound character of electrified vehicles.

Saturday, June 24, 2017

Morning Breakout Sessions

Technical Session 1: Power Electronics and Motor Drives- 1 Session Chair: Sriram Jala, Ford Motor Company, Dhafar Al-Ani, FCA US LLC	
Saturday, June 24, 2017, 8:30 AM – 10:10 AM, Room 301	
TS1-1	**Shipboard Power Quality Management Using the Controllably Inductive Power Filtering Method** *Qianyi Liu, Yong Li, Bin Xie, Sijia Hu, Lingxiong Zeng, Longfu Luo, Hunan University, Fang Liu, Central South University*
TS1-2	**Sensorless Torque-Controlled Induction Motor Drive for EV Applications** *Ehsan Dehghan-Azad, Shady Gadoue, David Atkinson, Newcastle University, Howard Slater, Peter Barrass, Sevcon Ltd.*
TS1-3	**Extreme Operation of IGBTs** *Yanjun Feng, Tianjiao Liu, Zaki Ahmad Daniyal, Aref Moradkhani Roshandeh, Z. John Shen, Illinois Institute of Technology*
TS1-4	**1kW, 400V/12V High Step-Down DC/DC Converter: Comparison Between Phase-Shifted Full-Bridge and LLC Resonant Converters** *Jiangheng Lu, Alireza Khaligh, University of Maryland*
TS1-5	**Extracting Parasitic Inductances of IGBT Power Modules with Two-Port S-Parameter Measurement** *Tianjiao Liu, Yanjun Feng, Runtao Ning, Thomas T. Y. Wong, Z. John Shen, Illinois Institute of Technology*

Technical Session 2: Grid Connectivity, Metering, and Charging Infrastructures-1 Session Chair: Khurram Afridi, University of Colorado - Boulder	
Saturday, June 24, 2017 8:30 AM – 10:10 AM, Room 302	
TS2-1	**Optimal Sizing of Inverters and Energy Storage for Power Oscillation Limiting in Grid Connected Large Scale Electric Vehicle Park with Renewable Energy** *Hassan Eldeeb, Abla Hariri, Christopher Lashway, Osama A. Mohammed, Florida International University*
TS2-2	**Potential for Plug-in Electric Vehicles to Provide Grid Support Services** *Fernando Dias, Yusheng Luo, Manish Mohanpurkar, Rob Hovsapian, Don Scoffield, Idaho National Laboratory*
TS2-3	**Electric Submetering Regulations for Commercial Dispensing of Electricity as a Fuel, Type Certification and Testing Program Development** *Theodore Bohn, Argonne National Laboratory*
TS2-4	**A Modular Single-Phase Bidirectional EV Charger with Current Sharing Optimization** *Faik Elvan, Hacettepe University, Mithat Kisacikoglu, University of Alabama*
TS2-5	**Transient Stability Augmentation with Excessive Regeneration Detection in a Delayed WADC** *Dakota Roberson, John O'Brien, University of Wyoming*

Saturday, June 24, 2017

Morning Breakout Sessions

Technical Session 3: Battery and Battery Management Systems-1 **Session Chair: Mohammad Saad Alam, Aligarh Muslim University, and Phil Kollmeyer, McMaster University**	
Saturday, June 24, 2017 **8:30 AM – 10:10 AM, Room 303**	
TS3-1	**Electrothermal Behavior of Lithium-Ion Batteries with Different Levels of Power Fade** *Zhuo Yang, Devendra Patil, Babak Fahimi, University of Texas at Dallas*
TS3-2	**Improved Cascaded Multilevel Battery Inverters with Phase-to-Phase SOC Balancing Capability** *Zuhair Alaas, Caisheng Wang, Chenguang Jiang, Chen Duan, Jianfei Chen, Wayne State University*
TS3-3	**A Review of Front End AC-DC Topologies in Universal Battery Charger for Electric Transportation** *Jaya Sai Praneeth A V, Sheldon S. Williamson, University of Ontario Institute of Technology*
TS3-4	**Optimization Through Rapid Meta-Model Based Transient Thermal Simulation of Lithium Ion Battery Cells** *Matthias Kerler, Felix Hoffmann, Markus Lienkamp, Technische Universität München*
TS3-5	**Battery State of Charge Estimation Using an Artificial Neural Network** *Mahmoud Ismail, Rioch Dlyma, Ahmed Elrakaybi, Ryan Ahmed, Saeid Habibi, McMaster University*
Technical Session 4: Modeling, Simulation, and Control-1 **Session Chair: Rakib Islam, Nexteer Automotive**	
Saturday, June 24, 2017 **8:30 AM – 10:10 AM, Room 304**	
TS4-1	**Direct Model Predictive Control of Five-Level Dual Flying Capacitor Active Neutral Point Clamped Converters with Modified Sphere Decoding** *Zhenbin Zhang, Jochen Schenek, Ralph Kennel, Technische Universität München*
TS4-2	**Modeling and Simulation of Optimal and Adaptive Real-Time Energy Management System for Automated Driving** *Kirill Gorelik, Ahmet Kilic, Robert Bosch GmbH, Roman Obermaisser, Universität Siegen*
TS4-3	**Analysis of the Impact of Battery Electric Vehicles on the Low Voltage Network of a Caribbean Island** *Gerald E. Mahadeo, Sanjay Bahadoorsingh, Chandrabhan Sharma, University of the West Indies*
TS4-4	**Dynamic Analysis of Diesel Generator Set Under Cylinder Deactivation** *Jishnu Kavil Kambrath, Aaron Alexander Ayu, Youyi Wang, Yong-Jin Yoon, Nanyang Technological University, Xiong Liu, Gary Wilson, Chandana Jayampathi Gajanayake, Amit Kumar Gupta, Rolls Royce Singapore Pte. Ltd*
TS4-5	**A Control Algorithm to Reduce Electric Vehicle Battery Pack RMS Currents Enabling a Minimally Sized Supercapacitor Pack** *Brittney Kerns, Tobias Lindsay, Todd Williams, Wilson Eberle, University of British Columbia*

Saturday, June 24, 2017

Morning Breakout Sessions

Technical Session 5: Electrical Systems and Components for Sea, Undersea, Air and Space Vehicles
Session Chair: Paolo Omenetti, Loccioni USA Inc and Hao Ge, McMaster University

Saturday, June 24, 2017
8:30 AM – 10:10 AM, Room 305

TS5-1	**Genetic Algorithm Design of an Adaptive, Multirate LQR Controller for a Multi-Machine MVDC Shipboard Electric Distribution System with Constant Power Loads** *Adam Mills, Robert Ashton, Naval Postgraduate School*
TS5-2	**Early-Stage Design of Integrated Power and Energy Systems for Naval Vessels Electrification: Advanced Modeling Using CSI** *Daniele Bosich, Vittorio Bucci, Ubaldo la Monaca, Alberto Marinò, Giorgio Sulligoi, Andrea Vicenzutti, Università degli Studi di Trieste, Genaro Lipardi, Italian Navy*
TS5-3	**X-57 Power and Command System Design** *Sean Clarke, Matthew Redifer, Kurt Papathakis, Aamod Samuel, National Aeronautics and Space Administration, Trevor Foster, Empirical Systems Aerospace, Inc.*
TS5-4	**Transient Analysis for H-Bridge Type DC Circuit Breaker** *Pradya Prempraneerach, Rajamangala University Technology, Chathan Cooke, Chryssostomos Chryssostomidis, Massachusetts Institute of Technology*

Technical Session 6: Power Electronics and Motor Drives-2
Session Chair: Ryan Ahmed, General Motors and Alan Callegaro, McMaster University

Saturday, June 24, 2017
10:30 AM – 12:10 AM, Room 301

TS6-1	**Topological Overview on Power Converters for Solid State Transformer Traction Technology in High Speed Trains** *Deepak Ronanki, Siddhartha Singh, Sheldon S. Williamson, University of Ontario Institute of Technology*
TS6-2	**Optimal Design Methodology for Dual Active Bridge Converter Under Wide Voltage Variation** *Vishnu Mahadeva Iyer, Srinivas Gulur, Subhashish Bhattacharya, North Carolina State University*
TS6-3	**High Efficiency Silicon Carbide DC-AC Inverter for EV-Charging Flywheel System** *Alexandre De Bernardinis, Abdelfatah Kolli, Jean-Pierre Ousten, Richard Lallemand, French Institute of Science and Technology for Transport, Development and Networks*
TS6-4	**Torque and Power Improvement for a Variable Flux Permanent Magnet Synchronous Machine** Akrem Mohamed Aljehaimi, Pragasen Pillay, Concordia University
TS6-5	**Modified Phase Disposition PWM Technique for Modular Multilevel Converters** Deepak Ronanki, Sheldon S. Williamson, University of Ontario Institute of Technology

Saturday, June 24, 2017

Morning Breakout Sessions

Technical Session 7: Electric Machines and Actuators-1
Session Chair: Sanjaka Wirasingha, Valeo and Rong Yang, McMaster University

Saturday, June 24, 2017
10:30 AM – 12:10 AM, Room 302

TS7-1	**Current Sensorless Control Using a Nonlinear Observer Applied to a Wound Rotor Synchronous Machine** *Adrien Corne, Jean-Philippe Martin, Babak Nahid-Mobarakeh, Serge Pierfederici , Universite de Lorraine*
TS7-2	**Analysis of Temperature Effects on Performance of Spoke-Type Interior Permanent Magnet Machines** *Silong Li, Di Han, Bulent Sarlioglu, University of Wisconsin-Madison*
TS7-3	**Mitigation of Electromagnetic Vibration in PMSM: A Rotor Position Related Variable Switching Frequency Technique** *Zhi Yang, Selin Yaman, Mahesh Krishnamurthy, Illinois Institute of Technology*
TS7-4	**Inter-Turn Fault Modeling in IPMSMs for Flux and Fault Index Estimation, and Torque Compensation** *Pablo Castro Palavicino, Bulent Sarlioglu, University of Wisconsin-Madison*
TS7-5	**A Generalized Approach for Determining Electric Machine Drive Switching Schemes Using Evolutionary Optimization Algorithms** *Tim Burress, Oak Ridge National Laboratory, Daniel Costinette, University of Tennessee – Knoxville, Jason Pries, Lixin Tang, Oak Ridge National Laboratory*

Technical Session 8: Battery and Battery Management Systems-II
Session Chair: Sheldon Williamson, University of Ontario Institute of Technology, Michael Kasprzak, FCA US LLC and Ephram Chemali, McMaster University

Saturday, June 24, 2017
10:30 AM – 12:10 AM, Room 303

TS8-1	**Internal Temperature Prediction of Lithium-Ion Cell Using Differential Voltage Technique** *Yashraj Tripathy, Andrew McGordon, John Low, James Marco, University of Warwick*
TS8-2	**Modeling Discharge Characteristics for Predicting Battery Remaining Life** *Jide Lu, Longfei Wei, Maneli Malek Pour, Yemesearch Mekonnen, Arif Sarwat, Florida International University*
TS8-3	**Investigation of the Impact of Battery Stack Monitor Accuracy on EKF-Based SoC Estimation Algorithms for Electric Vehicles** *Ye Li, Linear Technology Corp.*
TS8-4	**Passive Tracking of the Electrochemical Impedance of a Hybrid Electric Vehicle Battery and State of Charge Estimation Through an Extended Kalman Filter** *Nicolas Sockeel, John Ball, Mississippi State University, Masood Shahverdi, California State University, Los Angeles, Michael Mazzola, Mississippi State University*
TS8-5	**Li-Ion Battery Model Performance for Automotive Drive Cycles with Current Pulse and EIS Parameterization** *Phillip Kollmeyer, McMaster University, Andreas Hackl, Graz University of Technology, Ali Emadi, McMaster University*

Saturday, June 24, 2017

Morning Breakout Sessions

Technical Session 9: Modeling, Simulation, and Control-II Session Chair: Jin Ye, San Francisco State University	
Saturday, June 24, 2017 10:30 AM – 12:10 AM, Room 304	
TS9-1	**Sensitivity Analysis of the Battery Model for Model Predictive Control Implemented Into a Plug-in Hybrid Electric Vehicle** *Nicolas Sockeel, Jian Shi, Mississippi State University, Masood Shahverdi, California State University, Los Angeles, Michael Mazzola, Mississippi State University*
TS9-2	**Modeling and Validation for Zero Emission Buses** *Xianyong Feng, Michael Lewis, Clay Hearn, University of Texas at Austin*
TS9-3	**Reduced-Order Thermal Modeling of Liquid-Cooled Lithium-Ion Battery Pack for EVs and HEVs** *Fan He, Abhid Akram Ams, Yeliana Roosien, Wei Tao, Bruce Geist, Ken Singh, FCA US LLC*
TS9-4	**Modeling, Control, and Simulation Methods for Series Hybrid Heavy-Duty Commercial Vehicles Powered by Motor Tandem Axle Module** *Zicheng Tang, Leo Oriet, Edward Lang, Yi Zhan, University of Windsor*
TS9-5	**Commissioning of a Motor-Generator Unit** *Lee Sargent, David Taylor, Georgia Institute of Technology*

Technical Session 10: Range Extended Vehicles and Fuel Cell Electric Vehicles Session Chair: Fei Gao, University of Technology of Belfort-Montbeliard	
Saturday, June 24, 2017 10:30 AM – 12:10 AM, Room 305	
TS10-1	**Whole-Day Driving Prediction Control Strategy to Minimize PHEV Cost** *Petru Palcu, Jennifer Bauman, McMaster University*
TS10-2	**Predictive Energy Management for a Range Extended Vehicle** *Soeren Scherler, Xiaobo Liu-Henke, Marian Goellner, Ostfalia University of Applied Sciences*
TS10-3	**EU-US Evaluation of Range Extended Electric Vehicle Performance at Varying Ambient Temperatures** *Kevin Stutenberg, Argonne National Laboratory, Maria-Cristina Galassi, Marcos Garcia Otura, Germana Trentadue, Harald Scholz, Massimo Carriero, European Commission, Henning Lohse-Busch, Argonne National Laboratory*
TS10-4	**Equivalent Consumption Minimization Strategy for Fuel Cell Hybrid Electric Vehicle Considering Fuel Cell Degradation** *Huan Li, Alexandre Ravey, Abdoul N'Diaye, Abdesslem Djerdir, Université de Technologie de Belfort-Montbéliard*
TS10-5	**Detection of Cell-Stack Inhomogeneities via Mechanical SOC and SOH Measurement** *Fabian Ebert, Gerhard Sextl, Fraunhofer Institute for Silicate Research ISC, Jörn Adermann, Christoph Reiter, Markus Lienkamp, Technische Universität München*

Saturday, June 24, 2017

Afternoon Breakout Sessions

Technical Session 11: Power Electronics and Motor Drives-III Session Chair: Peter Azer, McMaster University and Ying Cui, McMaster University	
Saturday, June 24, 2017 2:00 PM – 3:40 PM, Room 301	
TS11-1	**Design and Performance Analysis of a 48V Electric Drive System for a Cargo Tricycle** *Daniel Grünstäudl, Johannes Gragger, Bernd Plassnegger, Austrian Institute of Technology GmbH, Mario Eibl, Gleam Technologies GmbH, Christian Sandner, Miba AG, Dietmar Andessne, Linz Center of Mechatronics GmbH, Markus Kocagöz, Austrian Institute of Technology GmbH*
TS11-2	**Zero State Common Mode Voltage Control in Motor Drives Through Inverter Topology** *Di Han, Yujiang Wu, Silong Li, Bulent Sarlioglu, University of Wisconsin-Madison*
TS11-3	**Adoption of Wide Bandgap Technology in Hybrid/Electric Vehicles-Opportunities and Challenges** *Di Han, Silong Li, Woongkul Lee, Bulent Sarlioglu, University of Wisconsin-Madison*
TS11-4	**Evaluation of a Novel Common Mode EMI Reducing Inverter Topology Utilizing Wide Bandgap Devices** *Casey Morris, Di Han, Wooyoung Choi, Bulent Sarlioglu, University of Wisconsin-Madison*
TS11-5	**Bidirectional Three-Level DC-DC Converters: Sum-Difference Modeling and Control** *Michael Eull, Matthias Preindl, Columbia University*

Technical Session 12: Electric Machines and Actuators-II Session Chair: Kartik Iyer, University of Minnesota, Ghanshyam Shrestha, U.S. ABB Inc.	
Saturday, June 24, 2017 2:00 PM – 3:40 PM, Room 302	
TS12-1	**Winding Factor Analysis of Star-Delta Windings** *Boris Dotz, Feaam GmbH, Dieter Gerling, Universität der Bundeswehr München*
TS12-2	**Five-Phase External Rotor Permanent Magnet Assisted Synchronous Reluctance Motor for in-Wheel Applications** *Sai Sudheer Reddy Bonthu, Zakirul Islam, Akm Arafat, Seungdeog Choi, University of Akron*
TS12-3	**Performance Comparison Between Three-Phase and Five-Phase Ferrite Permanent Magnet Assisted Synchronous Reluctance Motor** *Zakirul Islam, Seungdeog Choi, University of Akron*
TS12-4	**Design Considerations of Switched Reluctance Machines for Structural Vibration Reduction** *Cong Ma, Nexteer Automotive, Liyan Qu, University of Nebraska-Lincoln*
TS12-5	**Thermal Trade-Off Analysis of an Exterior Rotor E-Bike Switched Reluctance Motor** *Brock Howey, Elizabeth Rowan, Berker Bilgin, Ali Emadi, McMaster University*

Saturday, June 24, 2017

Afternoon Breakout Sessions

Technical Session 13: Wireless and Resonant Chargers Session Chair: Theodore Bohn, Argonne National Laboratory	
Saturday, June 24, 2017 2:00 PM – 3:40 PM, Room 303	
TS13-1	**A Wireless Powered EV Battery Charger for Sinusoidal Current Charging Technique with Maximum Efficiency Control** *Devendra Patil, Zhuo Yang, Babak Fahimi, University of Texas at Dallas*
TS13-2	**A Quasi-Resonant Bi-Directional Buck-Boost Converter for Electric Vehicle Applications** *Hadi Moradisizkoohi, Osama A. Mohammed, Florida International University*
TS13-3	**The Effects of the Resonant Network and Control Variables on the DC-Link Capacitor of a Wireless Charging System** *Nomar González-Santini, Michigan State University, Burak Ozpineci, Madhu Chinthavali, Oak Ridge National Laboratory, Fang Zheng Peng, Michigan State University*
TS13-4	**Performance Analysis of an Inductive Wireless Power Transfer System Applied for Electric Vehicles Considering Operating Limits** *Pirooz Javanbakht, Grace Liu, Mohamad Abdul-Hak, Judy Brunson, Oliver Cordes, Mercedes-Benz Research and Development North America, Inc., Salman Mohagheghi, Colorado School of Mines*
TS13-5	**High-Performance Large Air-Gap Capacitive Wireless Power Transfer System for Electric Vehicle Charging** *Brandon Regensburger, Ashish Kumar, Sreyam Sinha, Kate Doubleday, Saad Pervaiz, Zoya Popovic, Khurram Afridi, University of Colorado Boulder*

Technical Session 14: Thermal Management, Packaging, Optimization, and Performance of Traction Drive Systems Session Chair: Beijing Wang, FCA US LLC and Berker Bilgin, McMaster University	
Saturday, June 24, 2017 2:00 PM – 3:40 PM, Room 304	
TS14-1	**Scalable Performance, Efficiency and Thermal Models for Electric Drive Components Used in Powertrain Simulation and Optimization** *Gabriel Domingues, Francisco Márquez-Fernández, Pontus Fyhr, Avo Reinap, Mats Andersson, Mats Alaküla, Lund University*
TS14-2	**Design and Optimization of 3D Printed Air-Cooled Heat Sinks Based on Genetic Algorithms** *Tong Wu, Burak Ozpineci, Madhu Chinthavali, Zhiqiang Wang, Suman Debnath, Steven L. Campbell, Oak Ridge National Laboratory*
TS14-3	**A Reconfigurable-Winding System for Electric Vehicle Drive Applications** *Lixin Tang, Tim Burress, Jason Pries, Oak Ridge National Laboratory*
TS14-4	**Benchmarking Power Transistors and Power Modules for High-Temperature Operation (Tj~200°C)** *Alberto Adan, Hidekai Nakagawa, Yuji Kakizaki, Louis Burgyan, LTEC Corporation*
TS14-5	**Thermal Management and Cooling of Windings in Electrical Machines for Electric Vehicle and Traction Application** *Mingda Liu, Yingjie Li, Hao Ding, Bulent Sarlioglu, University of Wisconsin-Madison*

Saturday, June 24, 2017

Afternoon Breakout Sessions

Technical Session 15: Electrification of Heavy-Duty Vehicles and Fast Charging Session Chair: Alexandre De Bernardinis, IFSTTAR, France	
Saturday, June 24, 2017 2:00 PM – 3:40 PM, Room 305	
TS15-1	**Design and Modeling for Hydrogen Fuel Cell Conversion of Parcel Delivery Trucks** *Michael Lewis, Clay Hearn, Xianyong Feng, University of Texas at Austin, Jason Hanlin, Jaimie Levin, Center for Transportation and the Environment, Joseph Ambrosio, Unique Electric Solutions, Peter Guggenheim, Craig Walker, Valence Technologies*
TS15-2	**Assessing the Impact of an Electric Bus Duty Cycle on Battery Pack Life Span** *Anaissia Franca, Julian Alberto Fernandez, Curran Crawford, Ned Djilali, University of Victoria*
TS15-3	**Optimal Design of DC Fast-Charging Stations for EVs in Low Voltage Grids** *Marjan Gjelaj, Chresten Træholt, Seyedmostafa Hashemi, Peter Bach Anderson, Danmarks Tekniske Universitet*
TS15-4	**Characterization of a Search Algorithm to Determine Number of Electric Vehicle Charging Stations Between Two Points on an Interstate or US- Highway** *Subhaditya Shom, Fares Al Juheshi, Ala'a Rayyan, University of Nebraska-Lincoln, Mohammad Abdul-Hafez, Khaled Shuaib, United Arab Emirates University, Mahmoud Alahmad, University of Nebraska-Lincoln*
TS15-5	**Energy Storage Systems for EVs with Two Propulsion Machines** *Huseyin Ayhan Yavasoglu, Scientific and Technological Research Council of Turkey, Chuan Shi, University of Maryland, Kursad Gokce, Scientific and Technological Research Council of Turkey*

Technical Session 16: Power Electronics and Motor Drives-IV Session Chair: Matthias Preindl, Columbia University and Lixin Tang, Oak Ridge National Laboratory	
Saturday, June 24, 2017 4:00 PM – 5:40 PM, Room 301	
TS16-1	**Online Compensation of Current Sensor Gain-Faults for Safety-Relevant IPM-Drives** *Benjamin Grothmann, Universität der Bundeswehr München, Thomas Poelsterl, Ostbayerische Technische Hochschule Regensburg, Dieter Gerling, Universität der Bundeswehr München*
TS16-2	**On the Concept of a Novel Reconfigurable Multi-Source Inverter** *Ephrem Chemali, Ali Emadi, McMaster University*
TS16-3	**Sensorless Direct Torque Control of Surface Permanent Magnet Synchronous Motors with Resilient Extended Kalman Filtering** *Xin Wang, Southern Illinois University Edwardsville, Bojian Cao, University of Pittsburg, Mahfuz Alam, Southern Illinois University Edwardsville*
TS16-4	**Separation of Torque Components Using Frozen Permeability and Maxwell Stress Tensor** *Naveen Kumar Endla, Ragavan Kanagaraj, Indian Institute of Technology Gandhinagar*

Saturday, June 24, 2017

Afternoon Breakout Sessions

Technical Session 17: Grid Connectivity, Metering, and Charging Infrastructures-II
Session Chair: Veda Galigekere, Oak Ridge National Laboratory and Fernando Dias, Idaho National Laboratory

Saturday, June 24, 2017
4:00 PM – 5:40 PM, Room 302

TS17-1	**Local Automatic Load Control for Electric Vehicle Smart Charging Systems Extensible via OCPP Using Compact Submeters** *Theodore Bohn, Argonne National Laboratory. Carlos Cortes, BTC Power Systems, Hal Glenn, 2G Engineering*
TS17-2	**A Direct DC Bus Voltage Regulation of the Variable Voltage Converter in the Electric Traction Drive System** *Taehyung Kim, Stanley Baek, University of Michigan-Dearborn*
TS17-3	**A Load-Managing Photovoltaic System for Electric Vehicle Charging** *Joseph Azzolini, Meng Tao, Arizona State University*
TS17-4	**A Multi-Level Bi-Directional Buck-Boost Converter Using GaN Devices for Electric Vehicle Applications** *Hadi Moradisizkoohi, Nour Elsayad, Alberto Berzoy, Christopher Lashway, Osama A. Mohammed, Florida International University*
TS17-5	**Coordinated Reactive Power Control of Single-Phase Grid-Connected Converter for Distributed Energy Resources Integration Considering Multiple Functionality Conflicts** *Rong Zeng, Zhiqiang Wang, Madhu Chinthavali, Oak Ridge National Laboratory*

Technical Session 18: Connected and Automated Vehicles
Session Chair: LaMont McAliley, Noblis, Inc. and Haochi Li, General Motors

Saturday, June 24, 2017
4:00 PM – 5:40 PM, Room 303

TS18-1	**A Low-Cost and Novel Approach in Gearshift Control for a Mild-Hybrid Powertrain** *Mohamed Awadallah, Peter Tawadros, Paul Walker, Nong Zhang, University of Technology Sydney*
TS18-2	**Fuel Economy Assessment of Semi-Autonomous Vehicles Using Measured Data** *Mitra Pourabdollah, Erik Bjärkvik, Florian Fürer, Björn Lindenberg, Klaas Burgdorf, Volvo Car Corporation*
TS18-3	**A Smart Car Model Based on Autonomous Intelligent Agents for Reducing Accidents** *Nikolaos Bourbakis, Wright State University, Miltiadis Alamaniotis, Lefteri Tsoukalas, Purdue University*
TS18-4	**Electric Roads: Reducing the Societal Cost of Automotive Electrification** *Pontus Fyhr, Gabriel Domingues, Mats Andersson, Francisco Márquez-Fernández, Hans Bängtsson, Mats Alaküla, Lund University*

Saturday, June 24, 2017

Afternoon Breakout Sessions

Technical Session 19: Modeling, Simulation, and Control-III Session Chair: Pirooz Javanbakht, Mercedes Benz, Dhafar Al-Ani, FCA US LLC	
Saturday, June 24, 2017 4:00 PM – 5:40 PM, Room 304	
TS19-1	**High Fidelity D–Q Modeling of Synchronous Machines Using Spectral Interpolation** *Jason Pries, Tim Burress, Oak Ridge National Laboratory*
TS19-2	**Optimal Design of Charging Stations for Electrified Transit Networks** *Nader El-Taweel,* York University, *Moataz Mohamed,* McMaster University, *Hany Farag,* York University
TS19-3	**A System Analysis and Modeling of a HEV Based on Ultracapacitor Battery** *Mohamed Awadallah, Peter Tawadros, Paul Walker, Nong Zhang, James Tawadros,* University of Technology Sydney
TS19-4	**Load Shedding Mitigation Through Plug-in Electric Vehicle-to-Home (V2H) System** *Mahdi Shafaati Shemami, Mohammad Saad Alam, M. S. Jamil Asghar,* Aligarh Muslim University

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2018 ITEC: Call for Papers

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4) Battery, Battery Management Systems, Chargers and Charging Infrastructures
5) Electric, Hybrid Electric, and Plug-in Hybrid Electric Vehicle System Architectures
6) Connected and Automated Vehicles, Smart Mobility, Intelligent Transportation Systems, and Vehicle Security
7) Smart Grid, Electrical Infrastructure, and V2G/V2I Applications
8) Electrification of Heavy-Duty and Off-Road Vehicles
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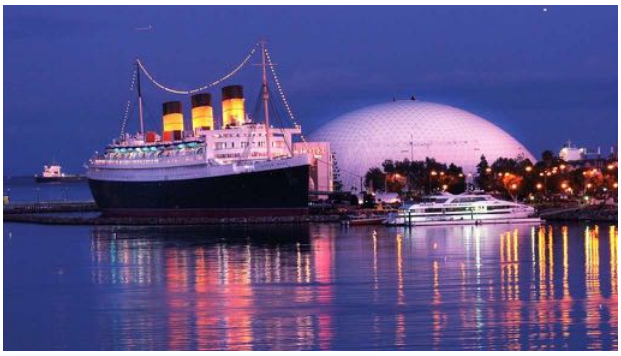

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iTEC2018

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Deadline for submission of paper proposals (abstracts/digests): **November 30, 2017**
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Deadline for submission of final camera-ready manuscripts: **April 20, 2018**
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