Tuesday, October 22

Neworking Reception
Session Code: HPMR
Room Michigan
Session Time: 5:30 p.m.

Tuesday, October 22

How Hybrids Evolved and How Complexity Was Kept in Check - includes Keynote Presentation by Takehito Yokoo, Toyota Motor Engineering & Mfg NA Inc.
Session Code: HPM100
Room Superior
Session Time: 8:00 a.m.

Attendees will hear how powertrains have gone from the traditional engine and transmission to today's highly developed systems. How have OEMs planned for this evolution in technology? Speakers will discuss how they were on the right path from the beginning in dealing with the complex integration and interaction of electric motors, inverters, bigger batteries, more software, and so on.

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<tr>
<td>8:00 a.m.</td>
<td>ORAL ONLY</td>
<td><strong>Keynote Presentation: Irreducible Complexity</strong></td>
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The challenge to reach toward sustainable transportation systems was instilled upon the forefathers of Toyota long before Toyota Motor Corporation existed. In 1925 Sakichi Toyoda challenged Japan, and the world, to develop advanced batteries that could be used in vehicle powertrains. His vision resulted in the Sakichi Battery Challenge which gave a million yen reward to anyone that could develop a battery that had the energy density comparable to gasoline. Although his challenge remains unmet even today, the spirit of his vision lives on in Toyota's hybrid technology. Hybrid technology represents the key technology that allows a wide diversification of automotive powertrains and enables the use of non-conventional fuels, like hydrogen. Today hybrid vehicles in the marketplace build upon the base of the gasoline internal combustion engine (ICE) by adding a high voltage battery, traction motor, generator, inverters, and a host of other technologies. In order for those pieces to work together to provide the performance the customer expects while also improving their efficiency we need to carefully consider hardware configuration and how to manage the complex relationships between all the components in that specific configuration. Today the complexities of hybrid architectures are impressive and although we try to reduce that complexity it is clear that some level will always exist. Moving forward the key issues will be how to balance the irreducible complexities while being able to provide the customer with the performance they expect and at a price they can afford.

Takehito Yokoo, Toyota Motor Engineering & Mfg NA Inc.
In order to meet new fuel economy regulatory requirements and target atmospheric CO2 reduction levels associated with light duty vehicles, a significant fraction of future vehicle propulsion systems will need to be hybrid electric and plug-in hybrid electric. Due to increased system complexity and pressure from increasingly shortened development timelines, HEV's and PHEV's present significant system design and integration challenges to meet given vehicle level targets and requirements with an appropriate attribute balance. The presentation outlines some of the critical vehicle level attribute and function trade-offs that must be addressed and the complexity associated with the dynamic system interactions that impact overall system design and optimization with respect to these attributes and functions. Further, the presentation makes the case that these cannot be addressed solely through traditional vehicle build-test-debug approaches. The presentation goes on to describe model-based system engineering analytical approaches being pursued at Ford that allow up front optimization of trade-offs and augment vehicle calibration and development for HEV's and PHEV's.

Mark J. Jennings, Ford Motor Co.

There are three significant energy issues pushing automotive powertrain design: global CO2 reduction, which is regulated through the GHG rule; local pollution reduction, which is regulated through Tier 2 rulings; and energy source diversity, which is regulated through renewable fuel standards. Companies are responding to the challenges with innovation that is both evolutionary and revolutionary, a combination of which will be necessary to meet the 2025 CAFE regulations. Ricardo has focused on a combination of engine downsizing, minor electrification and boosting, to achieve performance standards that consumers have come to expect from their vehicles.

Ali Maleki, Ricardo Inc.

Hybridized powertrains are going in number as fuel economy requirements increase. Their volumes, however, are still low in comparison to conventional powertrains. Furthermore, there is a need to introduce the technology to multiple platforms, which leads to multiple, low volume applications. In order to control the development and system cost, modularity can be used. Modularity and scalability can offer solutions for different applications from one developed platform. Solutions for 48V and high voltage systems will be presented.

Jeff Hemphill, Schaeffler Group USA Inc.

Electrifying a powertrain by adding electric drives, energy storage and their respected controllers dramatically increases the opportunity to realized improved performance, decreased fuel consumption and reduced tailpipe emissions. Realizing these benefits requires a paradigm change in the system development approach. In this presentation, the calibration topic in particular is studied and new approaches to this problem are summarized.

Jason McConnell, IAV Automotive Engineering Inc.
Tuesday, October 22

Containing Powertrain Complexity

Session Code: HPM400

Room Superior

Session Time: 1:00 p.m.

Attendees will discover how systems developers have addressed the challenges of ensuring hybrid powertrain operational efficiency while minimizing system complexity. The latest processes, testing, and simulation tools and techniques used to address these challenges will be discussed.

Chairpersons - Alan Brown, Hella Electronics Corp.

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<td>1:00 p.m.</td>
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<td><strong>Plug In Series Hybrid Vehicles - A Developers Perspective</strong>&lt;br&gt;Hybrid powertrains add an additional level of complexity to the development process, with additional functionality and legislative requirements. This presentation will take the audience through a typical development program for a Range Extended (REx) Plug-In Series Hybrid Vehicle, using examples from both the development of the MAHLE REx Demonstrator Vehicle and from a recent program to develop a retro-fit REx Powertrain for Medium Duty Trucks. It will discuss design decisions and the impact on manufacture, end user and service, looking at some of the tools and techniques used throughout the development process to ensure system quality, and how those can be carried through to production and into the service environment. Bernie Porter, MAHLE Powertrain LLC</td>
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<td>1:30 p.m.</td>
<td>ORAL ONLY</td>
<td><strong>Reducing Complexity of Hybrid Powertrain Motor Winding and Assembly</strong>&lt;br&gt;Motors in general, and as a recent subset, Hybrid Motors are facing a revolution in design. There are 2 factors which are driving this revolution: the complexity of the traditional “needle wound” manufacturing process and the maximum motor efficiency reached (primarily due to the copper wire fill factor on the stator winding). Today, several motor manufactures in various industries such as Automotive Hybrids, Automotive actuators (powertrain, transmission, air/fuel management, etc), Industrial automation, HVAC, Household appliances, Commodities are looking to improve their motor stator designs. Kumar Rajasekhar, Marsilli North America Inc.</td>
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<td>2:00 p.m.</td>
<td>ORAL ONLY</td>
<td><strong>Model-Based Design of Hybrid and Electric Powertrains</strong>&lt;br&gt;Sandeep Sovani, ANSYS Inc.</td>
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2:30 p.m.  ORAL ONLY  Increasing the Robustness of Hybrid Electric Vehicle Controls via System Simulation

System Simulation, a component of Model-Based System Engineering, is being utilized to provide a virtual Hardware-in-the-Loop simulation capability, which creates a framework for the development of ECU software by providing a platform upon which embedded control algorithms may be developed, tested, updated, and validated.

The development of virtual ECU software is increasingly valuable in hybrid electric vehicle control system engineering because these systems are becoming more complex and tightly integrated, which requires that interactions between subsystems be evaluated during the design process. Variation analysis and robustness studies are also important and become more difficult to perform with real hardware as system complexity increases.

The software tool and methodology described in this presentation permits algorithm development to be performed early in the product design cycle, prior to the availability of vehicle and control system hardware, by providing what is essentially a virtual integration vehicle. The software greatly facilitates the construction of a vehicle or propulsion system model by automatically connecting the components and subsystems that comprise it. A key element of this technique is the software-in-the-loop (SIL) capability, which permits compiled production controller code to be incorporated into the simulation environment, thus allowing the inclusion of algorithm functionality for which no simulation models exist.

Larry Michaels, Argonne National Laboratory

3:00 p.m.  Networking and Refreshment Break

3:30 p.m.  ORAL ONLY  Hybrid Maker: Should I Stay or Should I Go?

Sales of hybrid vehicles remain relatively low 13 years after their introduction. It's a good time for automakers to review the market progress of hybrids, to compare actual outcomes with expectations, and to decide what to do next. What tools are available to manage and evaluate a portfolio of technologies?

Walter S. McManus, UMTRI; Anson McManus, Mcmanus Analytics

4:00 p.m.  ORAL ONLY  Lowering EV & HEV Cost through a Portfolio Components Strategy

Electric Vehicles are faced with many cost challenges. In addition to battery cost issues, the industry continues to choose to develop specific components for specific applications. Establishing a common set of components and standards, preferably scalable components, could help provide economies of scale. In order to accomplish this, a strategic approach is recommended.

Bob Storc, Robert Storc Consulting

4:30 p.m.  Panel  Panel Discussion: Can We Contain Complexity?

Gone pretty much are the days of the simple ICE and a transmission and the ability to work on your car in your garage on the weekend. The powertrains of passenger cars are now of two types: those that have some level of electrification and those that will have. There is a growing concern now that these systems are becoming too complex with all of the new componentry and their integration into the powertrain. Will these systems also become repair nightmares for their second-, third- (or more) generation owners? Our panel will address how they see complexity being addressed to prevent it from becoming a potential mobility disaster for our society.

Moderators - Alan Brown, Hella Electronics Corp.
Wednesday, October 23

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Wednesday, October 23

Maintaining Hybrids: Reports from the Field - includes Keynote Presentation by Jeffrey Minter, Automotive Research & Design LLC
Session Code: HPM500 Room SuperiorSession Time: 8:00 a.m.

It is one thing to create, design and build these new powertrains, but what happens after the cars leave the dealers¿ lots? Attendees will learn about the various challenges that both operators and technicians encounter with respect to the maintenance and support of these complex systems. The latest tools and techniques used by technicians will be shared along with an open discussion on how these issues can be addressed during the systems design and development phase.

Chairpersons - Mark N. Pope, General Motors Co.

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| 8:00 a.m.| ORAL ONLY | Keynote Presentation: Hybrid Vehicle Service ¿ Is the Service Industry Ready?  
How is the Automotive Service Industry currently dealing with hybrid/electric vehicle diagnosis and repair? Are technicians being educated enough to accurately diagnose and repair these vehicles? There are already signs that the service industry is falling behind and the pace of change is constantly increasing. What are the implications of this so called ¿readiness gap¿? Will these vehicles be scrapped at 100,000 miles because of misdiagnosis or due to the high cost of a mechanical failure? Unfortunately that is already a reality in some cases. What are the long term implications if technician training needs aren¿t addressed and how can the situation be improved?  
Jeffrey Minter, Automotive Research & Design LLC  |
| 8:30 a.m.| ORAL ONLY | Avoiding High Tension in the Repair Shop: What Every Service Professional Should Know About Hybrids & EVs  
The presentation will focus on the importance of having the right diagnostics, service information and ongoing education available to technicians in order to successfully repair complex hybrid systems, as well as the business growth opportunities repair shops that specialize in hybrid service and repair can achieve. Concurrently, it will also examine the unique business challenges workshop managers face related to hybrid system repair, particularly when interacting with the consumer. It will close out his session reinforcing the importance of education, particularly when associated with emergency first responders.  
Christopher W. Bahlman, Delphi Corp. |
Providing for Excellence in Electrified Vehicle Maintenance Training: What Needs to Be Done to Ensure Success

Session Code: HPM600
Room Superior

Attendees will discover how both manufacturers and academia are addressing the operational challenges and systems complexity issues with technician training. There are only a small fraction of the trained technicians currently needed to repair the hybrid and electric vehicles. Speakers in this session will tell what is being done now to make sure that there are enough trained technicians to repair them in both the OE dealer and independent repair shops. College educators describe how they will be feeding more trained technicians in the repair shops.

Chairpersons - Jeffrey Minter, Automotive Research & Design LLC

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9:00 a.m.  ORAL ONLY Volkswagen Training and Serviceability for E-mobility

Volkswagen e-mobility is emerging globally. Although the volume of vehicles in the North American market is currently low, growth is expected in the area and technologies and processes are being developed to support anticipated growth. Training concepts encompass all dealer roles. Technician specific training includes various certification levels. Repair information determines what certification level is required depending on the operation performed. Model-specific training covers technical aspects of individual models. New model training is required for some levels of certification. Training levels are monitored in real time throughout the dealer network to assure brand requirements are met. Service and repair information is produced for the global market and determines service and repair for specific systems and components on the vehicles.

Dan Planz, VW Group of America

9:30 a.m.  Networking and Refreshment Break

10:00 a.m.  ORAL ONLY The Gap Effect

The disconnect in training, education and information from the manufacturers to the automotive aftermarket to the customer experience. Matt Curry will speak about the growing divide in information and education that trickles down from the manufacturers to the dealers and ultimately to technicians in the automotive aftermarket. Matt will relate his real world experience in the aftermarket and share his knowledge of customer experiences and what the customers perception are when facing repair issues with their Hybrid Electric Vehicles.

Matt Curry, Curry’s Auto Service

10:30 a.m.  Panel Panel Discussion: Controlling Vehicle Electrification with Service Information

This panel will present the results of a recent service survey of automotive technicians on electrical/hybrid vehicle service issues. The panel discussion will explore the reasons for the technician responses to the service survey. The service survey was a joint effort between the SAE Service Technology Program Committee (STPC) and IDC Manufacturing Insights.

Moderators - Mark N. Pope, General Motors Co.
Panelists - Christopher W. Bahlman, Delphi Corp.; Matt Curry, Curry’s Auto Service; Tony Molla, National Inst. for Auto Serv Excel; Dan Planz, VW Group of America;

12:00 p.m.  Networking Lunch and Exhibits
1:30 p.m. ORAL ONLY Talent Management Strategy to Meet the Challenge of Hybrid Powertrain Complexity

The plethora of hybrid powertrain choices as potential solutions to future fuel economy standards will challenge the organizational capabilities of OEM, suppliers, dealers, and other stakeholders. When combined with required technical advancements in associated vehicle systems, the resulting complexity will be dimensions beyond the means of traditional administrative approaches. The requisite innovations must be accomplished by a human capital pool recruited, developed, deployed and reprocessed in a compressed time scale under intense budget scrutiny even as market conditions remain in extreme flux. This presentation will introduce and describe some of the latest talent management concepts for securing a competitive advantage in such a complex environment.

Louis Wassel, Chrome Star Human Resource Advisors

2:00 p.m. ORAL ONLY ASE’s New Light Hybrid/Electric Vehicle Certification (L3)

This presentation will cover the latest information on a new certification test from the National Institute for Automotive Service Excellence (ASE), due to be launched in January, 2015. Along with a detailed description of the proposed Content areas and Task Lists covered by the new L3 certification, we will examine the development process to date.

Tony Molla, National Inst. for Auto Serv Excel

2:15 p.m. ORAL ONLY SAE Credentialing Vehicle Electrification (VE) Program

The presentation is to enlighten the audience on SAE International’s Professional Development initiatives to bring sector-wide credentialing programs to the industry. The topic of focus will be on the developing Vehicle Electrification program and product line, discussing how the process started and where the program is today.

Clinton Kehr, SAE International

2:30 p.m. Networking and Refreshment Break

3:00 p.m. ORAL ONLY Training the Technician for Hybrid Powertrains and Maintainability

This session will discuss local and national initiatives on training technicians at the college level to work in the field of hybrid and electric vehicles. Educational opportunities for all individuals will be discussed such as workshops, courses, certificates, degrees, and articulations to universities will be discussed.

Jennifer Seger, Macomb College

3:30 p.m. ORAL ONLY Education and Training for Hybrid Electric Vehicle Engineering

With the increasingly stringent regulations on hazardous emissions and fuel economy, various electric and hybrid electric vehicles (xEVs) have attracted more and more attention from automakers, policymakers, and customers. xEVs not only use additional electrical and electronic components, but also could include a conventional internal combustion engine. The challenges presented by these advanced powertrains include power management and optimization, hybrid controller development, and safety-critical fault-mitigation algorithms, all of which require significant expansion and shifting of engineering design methodologies and thinking. Aiming to prepare the next-generation automotive engineering workforces, this presentation will share some curriculum development and improvement experiences from Wayne State University’s one-of-the-kind, multidisciplinary, and industry-oriented master’s degree program in Electric-drive Vehicle Engineering (EVE), as well as its xEV student design competition in EcoCAR2: Plugging In to the Future.

Jerry C. Ku, Wayne State University
**Panel Discussion: When Will There Be Enough Adequately Trained Technicians to Service Advanced Electrified Powertrains?**

This panel of experts will discuss what has to be done between industry and education to train enough confident and knowledgeable technicians to service the increasing numbers of advanced electrified powertrains that are being produced here in the US. The demand for trained technicians steadily increases each year, yet many technicians are not able to accurately diagnose and correct problems in electrified powertrains. When will we have adequate numbers of technicians able to work on these advanced electrified powertrains as if they were traditional ICE powertrains?

**Moderators** - Louis Wassel, Chrome Star

**Panelists** - Jerry C. Ku, Wayne State Univ.; Jeffrey Minter, Automotive Research & Design LLC; Jennifer Seger, Macomb College; Louis Wassel, Chrome Star;

**Closing Remarks and Adjourn**

Jeffrey Minter, Automotive Research & Design LLC