Electric, Hybrid, and Plug-in Hybrid Vehicles
Principles and Applications with Practical Perspectives

The GATE Center for Electric Drive Transportation at the University of Michigan-Dearborn is pleased to offer a three-day training seminar for the GATE partner companies. Participants that complete all three days of training will be awarded 2.4 CEUs (continuing education units) upon request.

Dates: March 14-16, 2012  8:30 a.m. 4:30 p.m.

Venue: Professional Education Center, University of Michigan-Dearborn, 4901 Evergreen Road, Dearborn, MI 48128

Course description:

In response to ever-increasing energy demands and environmental concerns, the global automotive industry is heavily engaged in developing clean-vehicle technologies. Transportation electrification provides the most promising near and mid-term solution. This includes hybrid electric vehicles, plug in hybrid electric vehicles, and pure electric vehicles. Fuel economy improvements and emission reductions are achieved through engine down-sizing, regenerative braking, reduced engine idle/low speed consumption, and optimized engine operations. Availability of on-board electric energy storage enables capturing of energy during braking. In addition, fossil fuels can be replaced by clean electricity for plug-in hybrid or pure-electric vehicles.

Despite the fact that hybridization and electrification are clearly the future of transportation, the technology is still evolving. As a result, there is an increased demand for expertise in this area. The GATE Center for Electric Drive Transportation has been created in response to this demand. Additionally, a series of short courses will be developed to address industry needs.

*Electric, Hybrid, and Plug-in Hybrid Vehicles: Principles and Applications with Practical Perspectives* is the first in a series of short courses that will covers the key topics in electric drive vehicles, including fundamentals of electric drive vehicles, topology and dynamics of the hybrid powertrain, motors and power electronics, intelligent power management, thermal management, battery management systems, noise, vibration, and harshness (NVH), reliability, diagnostics and prognostics. Examples and case studies are included in all topics with practical perspectives.

Cost: The three-day course is offered at a minimal cost of $99.00 (to cover facilities and food expenses) for participants from industry partners of the GATE Center for Electric Drive Transportation. The public offering cost for the short course is $1395.00. Participants who wish to receive a certificate and university transcript of Continuing Education Units (CEUs) will be charged an additional $50 processing fee.
Course Outline

Day 1
1. Fundamentals of EV, HEV, and PHEV - Professor Chris Mi, 3 hours
2. Power Electronics and Electric Drives for Electric Drivetrain Applications - Professor Taehyung Kim, 2 hours
3. Hybrid Powertrain topology and dynamics - Professor Yi Zhang, 2 hours

Day 2
4. Intelligent Vehicle Power Management - Professor Yi Lu Murphey, 2 hours
5. Thermal Management of Electric Drive Vehicles Including Waste Heat Recovery - Professor Dohoy Jung, 2 hours
6. Noise, Vibration, and Harshness of Electric Drive Vehicles - Professor John Cherng, 2 hours
7. Standards and Codes Related to EV and PHEV Development – Ted Bohn, Argonne National Laboratory

Day 3
8. Battery Management Systems - Professor Chris Mi, 3 hours
9. Reliability of Electric Drive Vehicles - Professor Zhinmin Xi, 2 hours
10. Application of Nontechnology - Professor Ben Q. Li, 2 hours

The GATE Center for Electric Drive Transportation is a newly established center by the U.S. Department of Energy. For more information about the Center, please visit:

http://www.ur.umich.edu/update/archives/111102/gatecenter

For more information about the DOE GATE program, please visit:

http://energy.gov/articles/graduate-automotive-technology-education-gate-initiative-awards

For a list of industry partners of the GATE Center, please visit:

http://www.engin.umd.umich.edu/research/electricdrive

For questions related to registration, contact Susan Guinn, sguinn@umich.edu, (313)593-4000.

For technical questions related to the training: contact Prof. Chris Mi, chrisml@umich.edu, (313)583-6434.
Instructor Profiles:

Dr. Chris Mi is Associate Professor of Electrical and Computer Engineering, and Director of DTE Power Electronics Laboratory. Previously he was an Electrical Engineer with General Electric Canada Inc. His research interests include electric drives, power electronics, electric machines; renewable energy systems; electrical and hybrid vehicles. Dr. Mi has conducted extensive research and published more than 100 articles. Dr. Mi is the recipient of the “Distinguished Teaching Award” and “Distinguished Research Award” of University of Michigan Dearborn. He is also a recipient of the 2007 IEEE Region 4 “Outstanding Engineer Award,” “IEEE Southeastern Michigan Section Outstanding Professional Award,” and the “SAE Environmental Excellence in Transportation (E2T) Award.” He was vice Chair of the IEEE Southeastern Michigan Section from 2006 to 2007, and Chair in 2008. Dr. Mi was the general Chair of the 5th IEEE Vehicle Power and Propulsion Conference held in Dearborn, Michigan, USA in September 6-11, 2009. Dr. Mi is Associate Editor, IEEE Transactions on Vehicular Technology, Associate Editor, IEEE Transactions on Power Electronics – Letters, Senior Editor, IEEE Vehicular Technology Magazine, Guest Editor, International Journal of Power Electronics, Editorial Board, International Journal of Electric and Hybrid Vehicles, Editorial Board, IET Electrical Systems in Transportation, and Associate Editor of Journal of Circuits, Systems, and Computers (2007-2009). He is a member of the College Ph.D council and a member of the ASE program Committee.

Dr. Mi’s recent and current research projects include: (1) Advancing transportation through vehicle electrification, $2.2MM, April 2010 to March 2014. In this project, the PI works with Chrysler to develop 140 plugin hybrid Ram Trucks. (2). Transportation Electrification Education Partnership for Green Jobs and Sustainability Mobility, $240k, September 2009 to August 2013. In this project, the PI works with the University of Michigan – Ann Arbor and Kettering University to develop two undergraduate courses, two graduate courses, and two short courses in the area of EDVs. (3). Cognitive Intelligent Electric Power Optimization and Management, Real-time Hardware Implementation, and Enhancement of Silent Watch Capability, US Army, $160k, April 2010 to August 2012. In this project, an intelligent power management algorithm is developed to improve the fuel economy of plugin hybrid electric vehicles. (4). Michigan PHEV Pilot Project, $1MM, September 2008 to December 2012. In this project, the PI studied fast charger, inductive charger, V2G, and converted three Saturn Vue two-mode hybrids into plugin hybrid vehicles. In addition, the PI has worked with Ford and Honda on other four different types of PHEV programs in which four PHEVs were developed in the DTE lab.

Dr. Yi Zhang is Professor of Mechanical Engineering. His research interests are in the areas of design, dynamics and control of vehicle power transmission systems. He has worked closely with the automotive industry on the research and development of new types of automotive transmissions with significant fuel economy and drivability improvements for production vehicles. His work on the control and calibration of dual clutch transmissions has made important contributions toward the application of this new type of transmissions in the market models Fiesta and Focus. His work has been supported by the Ford University Research Program and the Ford Innovation Alliance. Dr. Zhang was one of the major contributors in establishing the curriculum of the Master’ Degree Program in Automotive Systems Engineering. He developed the automotive powertrain course series and teaches these courses regularly

Zhimin Xi is a Research Assistant Professor in the Department of Industrial and Manufacturing Systems Engineering at the University of Michigan – Dearborn. He received his B.S. and M.S. degree in mechanical engineering from Beijing University of Science and Technology and his Ph.D. from University of Maryland - College Park. He is the two-time winner of the Best Paper Award from ASME International Design Engineering Technical Conference (IDETC) in 2008 and 2011, respectively. His research interests are robust/reliability based design, model validation & verification, and multi-scale materials and product design.

Dr. Dohoy Jung is Assistant professor of Mechanical Engineering, His research interests are in the area of vehicle thermal management systems for conventional and hybrid vehicles. He developed an analytical model of a diesel-hybrid powertrain system integrated with a thermodynamics-based cooling system for an off-road hybrid electric vehicle
interests in research vehicle(s) (sponsored technologies) and Dr. and Mr. Dr. John Yi and Professor of Mechanical Engineering. He has more than twenty years of research experience in vibration and acoustics related areas. He is currently teaching both undergraduate and graduate vibration and acoustics courses and is in charge of the Acoustics and Vibrations Laboratory at UM-Dearborn. He has published more than 55 technical papers, two textbooks and three chapters of other books. He has been project director or principal investigator for more than 33 research grants and contracts. Most of them are vehicle noise and vibration related subjects.

Dr. Ben Q. Li is Professor and Chair of the Department of Mechanical Engineering. His research interest centers on the study of electromagnetics, fluid flow, and heat transfer in thermal-fluid systems. He received his Ph.D. from the University of California at Berkeley in 1989. He subsequently worked at Massachusetts Institute of Technology as a research associate for about a year, and at Aluminum Company of America (Alcoa) as a senior engineer for three years before joining academia. He has authored one book and edited two books. He has published over 200 technical papers in archive journals and conference proceedings. His research work has been supported by various federal (NSF, NASA, DOE, DOD, NIST) and state agencies as well as private industries. He is a Fellow of ASME.

Dr. Yi Lu Murphey is Professor and Chair of the Department of Electrical and Computer Engineering. Her research interests include machine learning, computer vision and intelligent systems with applications to engineering diagnostics, vehicle power management and robotic vision systems. Most recently she has received numerous research grants from the State of Michigan, Ford Motor Company, and US Army TACOM to support her research in intelligent vehicle power management. She has published over 100 technical papers and contributed a chapter of intelligent vehicle power management for the book titled “Computational Intelligence”.

Mr. Ted Bohn is Principal Electrical Engineer at the Argonne National Laboratory. He received his MS degree in Electrical Engineering from the University of Wisconsin-Madison. He has 22 years of experience in electrical engineering in industrial and research environments with emphasis on power electronics, electric machines, and control systems. He received the 2002 Grainger Outstanding Power Electronics Engineer Award. He has worked for 11 years in the area of hybrid electric vehicle-related design projects and organizing student vehicle design competitions.

As a member of the Curriculum Committee of the Department of Mechanical Engineering, Dr. Jung is responsible for the development of ESE course series. He has developed two courses in energy related areas, one for the undergraduate and another one graduate curriculum. Advanced Vehicle Energy Systems is a graduate course that covers advanced technologies and recent technical developments in automotive energy conversion systems such as hybrid electric vehicles, plug-in hybrids, fuel cell vehicles, alternative fuels and advanced IC engines.

In addition to the project director and co-PIs, the other six collaborating faculty all have expertise and experience in research and teaching in the thrust areas as highlighted in the following.

Dr. Taehyung Kim is Assistant professor of Electrical and Computer Engineering. His expertise include energy conversion, plug-in and fuel cell hybrid electric vehicles, power electronics and AC motor drives, electric and hybrid electric vehicle's traction motor drives, digital signal processor (DSP) based control for adjustable speed motor drives, evaluation & diagnosis of AC motors for military and commercial applications, and position sensorless control of AC motors. His research has been supported by NSF and automotive companies. He has recently received $200k funding from NSF Major Research Instrumentation (MRI) to establish battery testing facility as part of the Hybrid Powertrain Lab.

Dr. John Cherng is Professor of Mechanical Engineering. He has more than twenty years of research experience in vibration and acoustics related areas. He is currently teaching both undergraduate and graduate vibration and acoustics courses and is in charge of the Acoustics and Vibrations Laboratory at UM-Dearborn. He has published more than 55 technical papers, two textbooks and three chapters of other books. He has been project director or principal investigator for more than 33 research grants and contracts. Most of them are vehicle noise and vibration related subjects.

Dr. Ben Q. Li is Professor and Chair of the Department of Mechanical Engineering. His research interest centers on the study of electromagnetics, fluid flow, and heat transfer in thermal-fluid systems. He received his Ph.D. from the University of California at Berkley in 1989. He subsequently worked at Massachusetts Institute of Technology as a research associate for about a year, and at Aluminum Company of America (Alcoa) as a senior engineer for three years before joining academia. He has authored one book and edited two books. He has published over 200 technical papers in archive journals and conference proceedings. His research work has been supported by various federal (NSF, NASA, DOE, DOD, NIST) and state agencies as well as private industries. He is a Fellow of ASME.

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