Seminar by:
Badr Badreddine, Ph.D.
Control and Software development group
Ford Motor Company
Dearbon, MI USA

Hybrid Electric Vehicles Powertrain

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Abstract

Recently, Hybrid Electric Vehicles (HEV) have been attracting much attention in the auto industry due to environmental concerns and to the likelihood that some other energy alternatives such as fuel cell may not be ready for vehicle mass production in the very near future. An HEV typically comprises two powertrains – a conventional internal combustion engine and an electric motor drive. In order to achieve better fuel economy and emissions without compromising vehicle performance, a sophisticated control system is required to seamlessly integrate the two powertrains. Under various vehicle operations, the controller determines in real time the power allocation to the engine and the battery in a way to meet the driver's demand and minimize fuel economy and emissions. Testing Electronic Control (ECU) in vehicle is time consuming, costly and comes very late in the automotive development process. To achieve the highest quality of the developed product, testing must come as early as possible within the validation process. Therefore, CAE testing method using Hardware in the Loop (HIL) simulation is increasingly gaining ground in the automotive industry.

Short Bio of Dr. Badr Badreddine

Bader Badreddine is a technical expert engineer in the HEV Powertrain Control & Software development group at Ford Motor Company in Dearborn, MI. He is also an adjunct professor in the electrical engineering department at both the University of Michigan and Wayne State University. He holds a Ph.D in Electrical Computer Engineering from Wayne State University, which he acquired in December 2001 with specialty in control and communication. He received a B.S. and M.S. degrees, in Electrical Engineering from the University of Alabama, in 1985 and 1988 respectively, with specialty in communication and Laser/optics. He has over 15 years of experience in the field of automotive and control research engineering. He is currently involved in the research and development of HEV Model based control design and software strategies at Ford. He has taught several courses in Fuzzy Logic, computer controlled systems, analog electronics, and mathematics. He is the author of several hardware and software design specifications and design verification plans. He has several U.S. patents and Ford trade secrets awards. He has several IEEE and SAE publications/seminars in the field of Adaptive control, Fuzzy Logic, Laser and HEV. He has made a number of presentations at various U.S. Universities. The latest was at M.I.T. in Cambridge, Massachusetts.