electric & hybrid

vehicle technology international

ICON REBORN

It's taken eight years and the program has been rebooted countless times, but the NSX is back – and it's a plug-in hybrid tour de force

HACKED

As powertrains go from mechanical to electric, should the industry be worried about cybersecurity?

January 2016

LIQUID ASSET

It might only be a development mule, but BMW's hydrogen i8 promises a lot

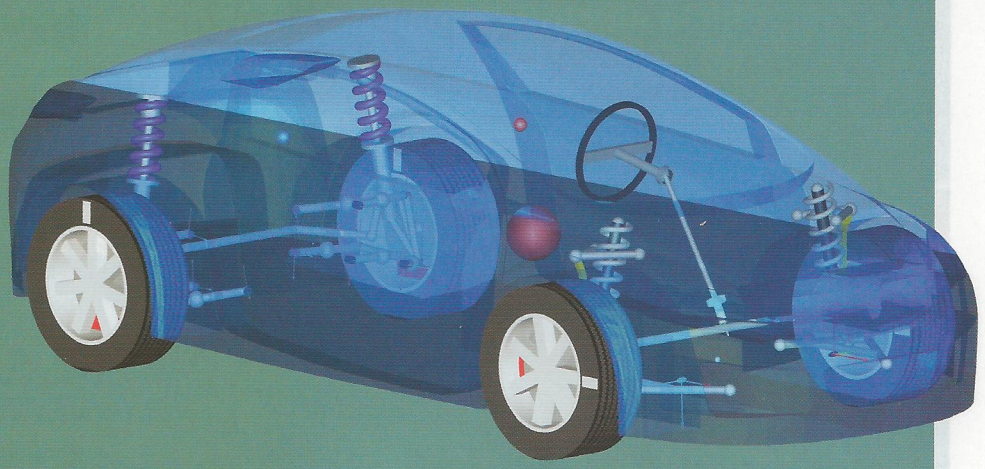
RANGE FINDER

Will lithium really put EVs in the same league as IC engine cars?

AUTONOMOUS JOURNEY

The technology is here, so when will we see driverless EVs out on the road?

Full vehicle simulation

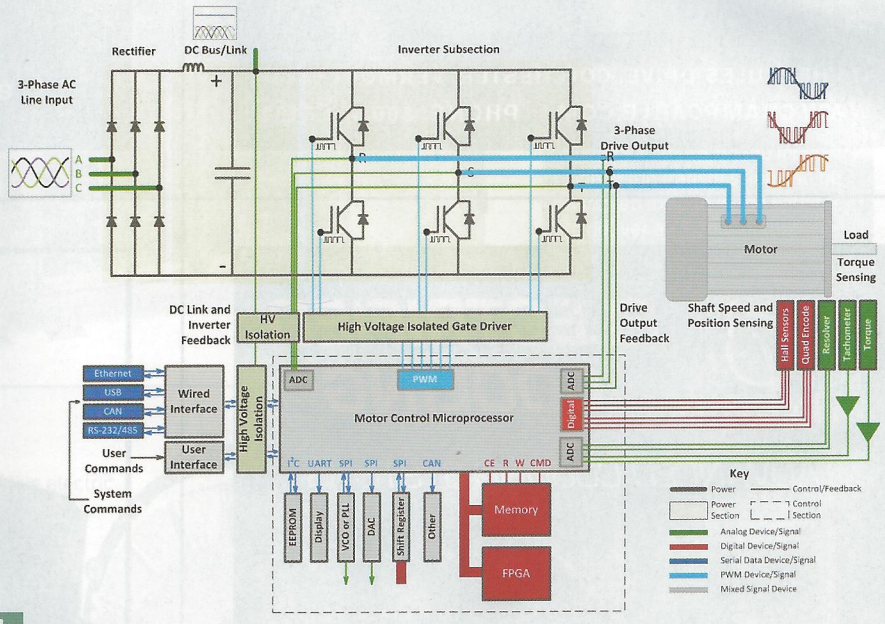


As vehicle complexity increases because of hybridization, more advanced driver assistance systems, and many other active systems, it becomes increasingly important to be able to simulate how these interact from an early stage in the development process.

Dymola is a multi-domain modeling and simulation tool that uses the Modelica modeling language to describe the behavior of components, devices and complete systems. The physical modeling approach means models are built from objects that represent the actual parts of the system and can cover mechanics, electrical, magnetic, thermal, fluid and control systems. This capability is encapsulated into a wide range of application libraries covering engines, powertrains, batteries, electric drives, vehicle dynamics, thermal management and human comfort.

Using the Modelica modeling language, Claytex has produced high-fidelity vehicle models that include every vehicle system. These technologies have been developed in motorsport and applied in Formula 1, NASCAR and IndyCar for many years, enabling teams to evaluate detailed changes or new technologies before arriving at the race track. Full vehicle models created using Dymola have been involved in the development of current F1 powertrains and driver-in-the-loop simulators, and are also used at the race track to support setup and strategy decisions.

The same technology is also used by OEMs and suppliers to simulate the same type of applications. Dymola supports many different ways to reuse the physical models, either through different types of analysis in Dymola, or by exporting the models for use in Simulink or other FMI-compliant tools.



Testing drivetrains dynamically, not statically

Electric and hybrid vehicles utilize high-performance motor drive designs with complex control and power electronics systems for four-quadrant motor control.

Traditionally, engineers make static power measurements, running the vehicle through a variety of distinct speed, torque, acceleration, and braking conditions to validate the complete propulsion system under various static test conditions. Test of 'static' conditions, meaning constant load and/or torque, fails to reflect real-world scenarios. Dynamic power measurements provide a valuable means of assessing performance under rapidly changing load or torque conditions that reflect operation in the real-world.

Correlating the dynamic power measurements to complex control behaviors is an essential part of understanding whether the complete drive system performs well under complicated operating conditions. The variable-frequency drive (VFD) DC bus, pulse-width modulated (PWM) AC output, and mechanical power (from torque transducers and, for speed, analog resolvers or quadrature encoder interfaces) signals need to be viewed and correlated to control or other mechanical system behaviors.

When the control signals are very high in frequency, as is common with vector field-oriented controls (FOC), conventional low-bandwidth data acquisition systems cannot capture and correlate control events to power events. Power analyzers also lack the ability to measure and display dynamic power conditions and behaviors. There are, however, test solutions available (such as Teledyne LeCroy's MDA series of motor drive analyzers) capable of accurate dynamic power measurements and analysis.