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Testing New Grounds in Automotive Electronics

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Testing New Grounds in Automotive Electronics

Manufacturers are increasingly designing products for ease of test.

WHEN IT COMES to automotive electronics it's all about cost and quality. With manufacturing real estate fetching a premium and automotive electronics getting smaller and more complex by the day, how are manufacturers gearing up to tackle the technology challenges?

The world of miniaturization has caught up with the automotive electronics industry. Indeed, Moore's Law has slowly but surely made its way into most modern vehicles on the road these days. Let's take a look at a few technology megatrends that are challenging the automotive electronics industry to look at more efficient ways to ensure the preservation of quality through efficient end-of-line testing before their products hit the road.

In demand – fresher air. The call for a cleaner environment through carbon footprint reduction is seriously heeded in the automotive industry. Manufacturers are constantly creating more efficient engines and engine control modules (ECMs) or management systems to reduce vehicle carbon emissions. This is achieved through the use of more sophisticated engine management electronics to create a more efficient engine.

The electric car is also gaining popularity. Under the hood of the electric car, banks of batteries replace the traditional pistons, aided by a battery of sophisticated electronics to regulate the utilization and deployment of power to various parts of the vehicle.

Even in the hybrid electric vehicle, electronics act like the brain and nervous system, giving vital feedback to regulate the combined usage of gasoline and electricity.

Muscle-powered initiatives. Government initiatives in the EU, US and Japan are driving the automotive industry toward cleaner mobility. These heavyweight initiatives have created a need for more stringent carbon emission control. Let's look at some standards on the horizon. The EU is targeting to reduce CO_2 emissions by improvement in vehicle technology to 130g/km from 2015, and to 95g/km by 2020 for passenger cars. In the US, fuel efficiency is targeted to improve to 35.5 mpg by 2016 and 54 mpg by 2025 for passenger cars and light trucks.

With the help of electronics, the automotive industry has made significant strides to improve fuel efficiency in vehicles. For example, automobile maker Ford has developed a new 1.0 liter engine called Ford Ecoboost to deliver power output performance equivalent to that of a 1.6 liter engine capacity.

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Constant communication. Another key megatrend driving these technology challenges is the convergence of an increasing volume of information on board the vehicle. Consumers are requesting more information be instantaneously available in a vehicle. For example, we are seeing the convergence of short message service, where the car can communicate with the driver's cellphone and automatically read SMSes to the driver, who can respond immediately via voice.

The desire to access emails on-the-go is also rising. Previously a prized feature in higher-end luxury vehicles, voice-assisted software acting as the driver's personal assistant, reading emails, taking dictation and carrying out simple commands is becoming a norm in midrange vehicles.

Commonplace features. We are also seeing more electronics put into entry-level cars. Features such as anti-lock braking or vehicle stability systems previously only available in high-end cars are becoming standard in entry-level vehicles. For example, the Ford Focus, a typical C segment passenger car, has auto-brake electronics that help to detect if a vehicle is too close ahead and automatically slows the car. Such features were available only in luxury vehicles as recently as a few years ago.

Downsizing the ECMs. In tandem with these megatrends, automotive electronics manufacturers have started compacting their electronic control modules (ECMs). Increasingly, we see a consolidation of modules – like how anti-lock braking or vehicle stability control modules are now being integrated into a single ECU. This not only saves space in the vehicle, but also cost, while permitting more electronic features to be loaded into entry-level vehicles.

Keeping costs down. The increase in complexity of ECUs does not equate to a license to increase vehicle prices. On the contrary, the competitive nature of this business means manufacturers have to maintain or even lower their manufacturing costs.

A common cost-reduction method is to increase throughput. In automotive electronics, the final quality gatekeeper is the functional test stage. Usually, this is one of the most demanding stations along the manufacturing line, as all possible functional defects must be captured before any module is packed and shipped. Increasingly, manufacturers are looking at designing products for ease of test. What this means is that even at the product design stage, they already need to consider how fast and how economically they can test the end-product on the manufacturing floor, what sort of functional test to deploy, and how easily they can move their test plan from the lab to the production floor, which could be halfway around the earth.

Instead of investing heavy manpower in in-house system integration, some manufacturers are opting to buy standard functional test equipment from specialist vendors, so their internal engineering resources can focus on developing test plans and fixtures, and not expend time on racking and stacking as well. Outsourcing test to specialists helps to maintain leaner manufacturing, which helps to ride out market volatility.

To help save money, manufacturers need also consider equipment with better and wider coverage. Standard functional test systems can support as many as 464 test points, up from 320 test points previously. Many complex ECMs these days have around 200 test points. In the past manufacturers needed to invest in two test systems (and twice the footprint), while new technology enables them to make do with one system – in short, halving the needed footprint, as well as the number of operators needed to run the station.

Parallel testing with throughput multipliers is another functional test method gaining wider adoption as manufacturers find the traditional sequential testing method too slow for their needs.

Impact of offshoring and inshoring. The flow of electronics manufacturing is very fluid these days. A test plan developed in the US or Germany could be deployed on the production floors of Guadalajara, Mexico or Penang, Malaysia. Hence, the functional test team needs to ensure their tests can run seamlessly no matter where the systems are deployed.

Likewise, in cases where production lines are relocated back to home countries, test plans need to be in sync to support systems brought back from overseas in order to maximize uptime. Increasingly, manufacturers find that it is easier to work with standard off-the-shelf equipment, where it is the responsibility of the equipment vendor to ensure their system works no matter where it is relocated in the world.

Some manufacturers have learned that after spending numerous man-hours developing new test systems, their nightmare began when trying to turn on these new features on their customized rack, which could comprise of equipment from various vendors. In such cases, it would have been easier to outsource the new feature requirement to test specialists.

Offshoring automotive electronics also demands a high degree of local knowledge in terms of safety qualification and compliance requirements. For instance, for any system making its way from the US to Korea, the user needs to ensure the system meets Korea's KCC safety requirements, while systems moving into Europe need to have the mandatory CE marking before they pass Customs. Any nonconformance can cause drastic delays to production schedules. In such events, manufacturers either need to have fail-proof in-house expertise, or a reliable vendor that can do the homework and legwork for them. **CA**