VEHICLE electronics

The monthly magazine for automotive electronics engineers

Connected cockpit ready for Electronica

A connected cockpit concept for vehicles has been developed by Visteon to connect all aspects of the car securely to the driver and cloud computing. It will be on show at the Electronica exhibition this month in Munich.

The Oasis (for optimised, adaptable, secure, intelligent and seamless) cockpit is designed to integrate the driver's custom profile to the vehicle infotainment system. The concept also tracks the driver's interaction with the vehicle and adapts to his or her preferences such as apps, pre-set controls and themes to deliver a customised driving experience.

It provides a secure data pipe that automatically switches connection types (modem, phone tether or Wifi) to maintain uninterrupted service to the cloud.

"Oasis protects the ve-

Visteon's connected cockpit will be at Electronica

hicle inside and out," said Mark Zeinstra, global connected services manager at Visteon. "Visteon secures the in-vehicle network to deliver seamless connectivity through a single access point allowing firewall protection and validation of all messages."

The concept is currently being shown to global vehicle manufacturers.

By using a web portal, the owner can review his or her driving history and vehicle diagnostics and

be alerted to potential vehicle maintenance needs. Car makers can use data analytics to determine how occupants are interacting with the vehicle controls to improve future iterations of the human-machine interaction.

"The smart data feature receives keen interest from customers," said Zeinstra. "They immediately begin brainstorming its potential as they consider the various ways this information can be used."

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Fleet management to soar in Americas

The installed base of fleet management systems will reach 12 million units in the Americas by 2018, according to analyst Berg Insight. Its report says the number of active fleet management systems deployed in commercial vehicle fleets in North America was 4.0m in 2013's final quarter. Growing at a CAGR of 15.3%, this is expected to reach 8.1m by 2018.

In Latin America, the number of active fleet management systems is set to increase from 1.9m in Q4 of 2013, growing at a CAGR of 16.1%, to reach 3.9m in 2018.

The top ten providers of fleet management systems in the Americas now have a combined installed base of more than 2.5 million active units in the region. Leading providers including Fleetmatics, Trimble, Zonar Systems and Telogis all have more than 300,000 active units in this market.

The consolidation trend in fleet management has continued and the market has seen major transactions in recent years. Qualcomm divested its Omnitracs business, which pioneered the fleet management industry in the 1980s. Omnitracs has acquired other providers – most notably the com-

peting heavy truck fleet management provider XRS with more than 100,000 subscribers. Fuel card and workforce payment provider Fleetcor has acquired Nextraq

based in the USA while the tyre manufacturer Michelin has acquired the Brazilian fleet management provider Sascar.

"These two deals are particularly interesting

due to the fact that the well-known acquirers are newcomers to the fleet management space," said Rickard Andersson, senior analyst at Berg Insight.

Brazilian plant takes the Leed

Borgwarner's production facility and engineering centre in Itatiba City, Brazil, recently received Leadership in Energy & Environmental Design (Leed) certification, a first for an automotive supplier in Brazil. Developed by the US Green Building Council, Leed certification affirms sustainable building strategies and practices. Inaugurated in 2013, the environmentally friendly Brazilian campus was designed and built to fulfil the requirements for Leed certification.

"For us, sustainability starts with an idea of how to use our natural resources wisely – including our global network of plants and campuses – and continues with our advanced technologies, specifically engineered to improve fuel economy, emissions and performance," said James Verrier, president and chief executive officer of Borgwarner.

At the facility, natural lighting helps reduce electrical power consumption by up to 97%. In addition, a highly efficient air conditioning system, the intelligent reuse of water and rainwater, and specific parking lots for low-emission vehicles contribute to the environmental sustainability of the entire campus.

Q7 could be answer to in-vehicle problems

The low power and small size of Q7 form factor embedded boards make them ideal for automotive applications, according to Neil Wood, who recently took over as UK regional sales manager for Congatec. He said typical of these were number plate recognition systems in police cars.

"These have to be low power and the Q7 is ideal for the requirement," he said at last month's Engineering Design Show in Coventry. "And you don't have thermal problems, so they can be fanless. It is a lot better than going for Com Express."

He said Q7 was suitable for almost anything that went into a car, such as control and monitoring in emergency vehicles, and infotainment systems that were computer based.

Neil Wood: "Q7 is ideal in that environment."

"We keep getting enquiries for a lot of in-vehicle applications and for vehicle diagnostics," he said. "Vehicle diagnostics use a lot of hand-held battery powered equipment, and Q7 is ideal in that environment."

He said this included on production lines as well as by garages for vehicle repairs and maintenance.

Most in-vehicle uses for Q7, he said, were in the aftermarket, for equipment added once the vehicle was on the road.

"We are seeing this more in Europe, but not so much in America and Asia," he said. "But we see America as a big key growth area for the future. I don't think Q7 is well known out there."

Adaptive headlights debut

Mazda showed its next-generation adaptive LED headlights at Ceatec in Tokyo last month. The autonomous high-beam control will become part of the car maker's I-Activsense safety line.

Adaptive LED headlights use LED array high-beam technology that splits the LEDs into four independently controllable blocks. Like high beam control, a related system available with all new-generation Mazdas, the adaptive headlights use a camera to detect oncoming and preceding vehicles.

But instead of switching off the high beams entirely to avoid impairing other drivers' vision, it shuts off only the LEDs shining in their direction, so the high beams remain always on, enhancing visibility and thus safety.

It also comes with wide-distribution low beams, which add LEDs to the sides of the headlamps to shed light where conventional headlights do not. Highway mode automatically adjusts the forward aim of the headlamps upwards when travelling at highway speeds to illuminate road signs and potential obstacles earlier.

Videantis and Viscoda join forces

Video analytics companies Videantis and Viscoda joined forces at last month's Ethernet and IP Automotive Technology Day in Detroit to demonstrate automotive vision algorithms and processing technology.

Viscoda's history is in algorithm development for digital image processing, computer vision and 3D scene analysis, while Videantis licenses scalable processors optimised for computer vision and video coding, bundled with software libraries.

"We launched our partner programme last year, and we're now very pleased to add Viscoda," said Hans-Joachim Stolberg, Videantis' CEO.

One feature of the combined system on display was that the adas algorithms don't run on a high-end multicore CPU and GPU combination in the dashboard. Instead, the algorithms run on a very small, low-power processor integrated inside the camera.

The right half of the image shows the field of view of the current S-Cam 3 technology and the left half illustrates the enhanced capabilities of the Tricam multi-lens camera

Camera aims to add more to adas

The next generation of TRW's camera system will have an expanded object detection range and field of view to meet adas requirements. The S-Cam 4 family – due out in 2018 – will include a single lens, mono-camera version based on a standard housing and mechanical package to help meet test protocols such as pedestrian triggered automatic emergency braking (AEB) and potential requirements including a crossing bicycle AEB test.

The three-lens Tricam 4 version will support advanced semi-automated driving functions. This adds a telephoto lens for improved long distance sensing, and a fish-eye lens for improved short range sensing for semi-automated driving functions such as highway driving assist and traffic jam assist.

"The S-Cam4 family represents another significant step forward in our roadmap to support adas and premium safety and comfort systems," said Peter Lake, TRW executive VP of sales and business development.

The family will be equipped with Mobileye's Eye Q4 image processor and object recognition algorithms together with TRW's longitudinal and lateral control algorithms to enhance performance in premium adas and semi-automated applications.

Packaging will include an integrated processor and imager in a size similar to a deck of cards.

Increase software testing call

There needs to be a radical change in attitude among software suppliers if recalls due to software problems are going to be reduced or stopped, believes John Paliotta, chief technology officer at Vector Software.

He said many companies made the mistake of giving the job of writing code to their best programmers and having others handling the requirements and testing, but he said it should be the other way round.

"I think they should have the best guys doing the interfaces and testing and let a kid do the implementation; it is not that important," he said at last month's Engineering Design Show in Coventry, UK. "It is the requirements and testing that are the key to quality, and not the code writing."

Tomtom uses real weather data

Satnav firm Tomtom aims to enable faster journeys by calculating routes based on actual weather conditions.

As well as providing precise traffic jam information, Tomtom Traffic now warns drivers about upcoming slow moving traffic due to heavy rain or snow. By being better informed about the weather situation up ahead, drivers can take smarter decisions about how to get to their destinations faster.

"By knowing the exact traffic situation across the entire road network we can calculate the quickest route to help people get to their destination faster," said Ralf-Peter Schäfer, head of Tomtom Traffic. "Bad weather can cause travel delays. By factoring this in, we give drivers advanced knowledge about the road ahead to make journeys faster and more predictable."

Isuzu banks on Telogis

Telogis and Isuzu Commercial Truck of America are collaborating to develop connected vehicle products and services. The resultant telematics system they hope will create a stronger ownership experience by improving overall vehicle performance.

"Today, Isuzu defines its connected vehicle and telematics strategy by collaborating with Telogis," said Shaun Skinner, executive VP and general manager of Isuzu Commercial Truck, at a dealer meeting in Albuquerque, New Mexico, celebrating Isuzu's 30th anniversary in the USA. "We chose Telogis because of their focus on innovation, and their industry-leading experience with built-in OEM location intelligence, with a mutual goal of providing Isuzu customers with the very best ownership experience in the medium-duty truck market."

Telogis provides a SaaS-based connected intelligence platform for companies that require telematics, route optimisation, commercial navigation, work order management and mobile integration services for their mobile workforces.

"The combination of Isuzu's leadership in the low-cab-forward commercial truck market and the innovative solutions on the Telogis platform will deliver significant cost savings and operational efficiencies for Isuzu customers," said Susan Heystee, executive VP at Telogis. "This next-generation technology brings Isuzu Truck built-in connectivity and intelligence that can only be achieved through this kind of collaboration with the manufacturer."

Sensors to give all-round view
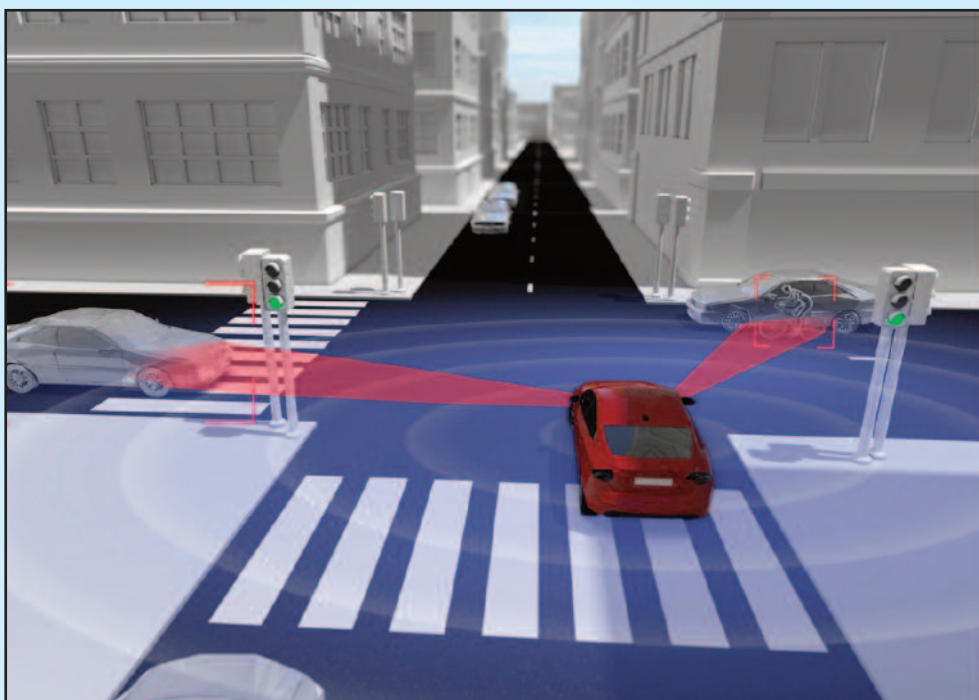
A Swedish collaboration started by Volvo between academia, various institutions and industry – the Non-Hit Car & Truck project – has developed sensor fusion technologies that provide a seamless 360° view around a car. One of the project's challenges was to build one cohesive detection system out of a number of discrete sensors installed around the car, something that has never before been accomplished. This required developing a centralised sensor fusion framework to enable the various technologies – cameras, radar, lidar, GPS and so on – to share information efficiently.

Through this framework, the system provides a complete 360° view of the environment and perceives any potentially threatening objects that drivers would otherwise not be able to see.

The 360° view is enhanced by the manoeuvre generator, a feature that uses software to identify collision-free escape routes in all traffic scenarios. It works by constantly analysing threats around the car, and can even assist drivers with auto-braking and steering.

FIA restricts Formula One innovation, says Mercedes technical director

FIA regulations are restricting engineering innovation in Formula One cars, claims Bob Bell, technical director for Mercedes AMG Petronas.

"Most engineers will agree that it is not as much fun because the regulations limit the innovation and creativity," he said at last month's Engineering Design Show in Coventry, UK. "But I am still impressed with the amount of innovation there is. There are still places where you can innovate."

He said there were times when you got moments of brilliant innovation that did not need lots of simulation and modelling, but sometimes there was just a spark of an idea but to make it work involved a huge amount of simulation and modelling.

"We want to encourage innovation," he said, "then work out how to manage it. I want people knocking on my door with new ideas. We concentrate on the young guys and work hard to make them work together from day one. We need them to work collaboratively and innovate collaboratively as we look for the best ways to ex-

Bob Bell: "I want people knocking on my door with new ideas."

ploit the regulations."

He said most changes in regulations were made for safety reason and despite Jules Bianchi's recent accident the sport had an enviable safety record.

"I get more worried when my daughter gets onto her event pony than I do when our drivers get into the cars," he said.

He said the reason Mercedes was dominating Formula One at the moment was that it was the first to find a good balance between the aerodynamics and the new powertrain regulations that came in this season.

"A good Formula One car is all about good compromise," he said. "Before this year, the powertrains were all on a fairly level playing field, but this year there is a vast difference between the different powertrains."

Another area of compromise comes from race telematics.

"If we let the data engineers and the simulation engineers have their way, you would have too many sensors on the car and the weight would go up," he said. "Again, we have to find a compromise."

He said what helped was the culture in Mercedes where they encouraged people to hold their hands up to mistakes.

"We don't point the finger back at them," he said. "We learn and we move on."

Pioneer licenses Abalta's Weblink

Pioneer is to license Abalta's Weblink for inclusion with its in-vehicle multimedia product line. By using Weblink, Pioneer car electronics customers can connect their smartphone via USB for easier set up and eliminate the need to purchase additional cables.

The first products with Weblink technology are expected before the end of the year.

"Pioneer is the global leader in the automotive aftermarket industry and their decision to use Weblink strongly validates our technology," said Michael O'Shea, president and CEO of Abalta Technologies.

Weblink creates a second virtual screen for apps on a smartphone that is then sent to a vehicle's screen via USB, Bluetooth or Wifi. Users benefit from the flexibility to use Android and iOs devices without additional set up. It also works with factory-installed vehicle infotainment systems.

Working together

Steve Rogerson reports from last month's Aesin automotive electronics conference at the University of Warwick, where he found a refreshing willingness for collaboration

Delegates were greeted by this Jaguar Land Rover Range E low carbon vehicle

Britain has always been good at forming committees and bodies to talk about problems, to produce reports about how to solve the problems, but the real problem is how to turn that talk into action. And for that you need not just talk but targets, not the isolation of individual organisations but cooperation and collaboration between them.

Thus it was refreshing to see at last month's Aesin automotive electronics conference at the University of Warwick not just Aesin but also the UK Automotive Council, Innovate UK and the Electronic Systems Council (Esco) all on the same platform offering support and getting behind Aesin's inaugural project of a connected corridor.

Aesin, a UK expert group focussed on automotive electronic systems, was established in September 2012 by a number of automotive sector organisations and NMI, the UK's electronic systems trade association, in response to the explosive growth of electronics in cars.

The collaborative research project aims to demonstrate the possibilities for novel services and business models when a car is reliably connected to a mobile wireless communications network. Its target is to produce results within 18 months.

"We have to work together to make the UK a more attractive place for start-ups and for corporates to invest," said Derek Boyd, chief executive of NMI, as he opened the conference. "If we work collectively, we can become a focus for the electronics industry helping it work with key verticals such as automotive. We provide a unique platform for people to work together. We can make this industry more attractive and stronger going forwards."

Managers paying lip service to quality

Despite high-profile legal cases such as the Toyota settlement, managers are still only paying lip service to ensuring software quality in safety critical automotive systems, according to Barry Lock (right), UK manager for Lauterbach.

The code in the Toyota case, he said, was spaghetti and contained undocumented legacy code.

"There were many possible ways of failure and it was badly designed," he said.

The response of management in the UK, he said, has been to specify ISO 26262 on most projects and say publicly that software and quality is high priority with unlimited budget.

"But the engineers are saying budgets are tighter than they have ever been," he said. "They are understaffed and timescales are tighter."

He said although available tools could help them, they were not used.

"We sell a thousand times more tools to mobile phone companies than we do to automotive," he said. "Though nobody in the UK is using our tools, their competitors in Europe and Asia are buying them in volume. Why is the UK not buying our tools? One engineer said if he asked for more budget to get more tools his job would be outsourced to India."

So, he said, we have senior managers in the UK saying they have the budget but the engineers on the ground saying they haven't.

"Somewhere in the middle, something is going wrong," he said. "I think the problem is the UK has too many accountants in management positions."

Sarah Macken: "We want to develop the UK."

Alan Banks: "I am keen to make this move."

Derek Boyd: "We can make this industry more attractive."

Alan Banks, chairman of Aesin, added: "The problem we are trying to solve with the connected corridor project is that we have a vast network in the UK that doesn't have the capacity or bandwidth. It is possible to have a connected car architecture and combine it with an intelligent transportation corridor."

Phase one, he said, has started to look at the feasibility and business case. Phase two will be an off-site moving demo and phase three an on-site live demo.

"The connected corridor is our first major project," said Banks. "I am keen to make this move."

Sarah Macken, chief executive of Esco, added: "We want to develop the UK as a centre for electronic system innovation. We are trying to make the UK as one of the best places in the world for investment in electronic systems. The internet of things is an area we are particularly involved in and this will connect with automotive in terms of connected devices."

She said the electronic systems sector in the UK had an annual turnover of around £80bn and Esco's aim was to help this grow to £120bn by 2020.

Jerry Hardcastle, chair of the Automotive Council's technology group and general manager of Nissan's technical centre, said: "There is a real opportunity for suppliers making premium products to establish a base in the UK. We want the tier ones to return to investing in R&D in the UK."

He said working together with Aesin was an effective way to consider the opportunities and challenges that were faced by the electronics supply chain and to develop coherent and complementary strategies to promote further mutual growth.

The project has also received support from industry. Helen Finch, senior manager for research and technology at Jaguar Land Rover, said: "We make sure we engage with the Automotive Council. This is important because it gives a consensus for the UK automotive industry and it makes sure we are working in the same direction as UK automotive developers."

The situation in the UK is reaching a critical point, believes John Miles, chair of the Automotive Council's intelligent mobility working group, as the country is one of the most congested on earth and the population in the UK is growing to the point where it could be the most populated country in Europe by 2035.

"If we put more and more demand on our transport infrastructure, then it reaches a point where it can't cope," he said. "Things will stop working, and we are getting very close to that. We need to solve this problem in an intelligent fashion."

Given that 92% of transportation in the UK is by road, this he said meant increasing traffic capacity by 30% by 2030 and 50% by 2050. At the same time, the number of accidents needs to be reduced, the user experience needs to improve and emissions

Jerry Hardcastle: "There is a real opportunity."

Helen Finch: "We engage with the Automotive Council."

Jon Horsley: "Automotive is undergoing wholesale change."

need to come down.

These he said were among the aims of the Lutz (Low-carbon Urban Transport Zone) programme. Part of the programme's vision is to look at personal mobility, which he said was not going to go away.

"We are looking at autonomous vehicles in terms of two-seater pods," said Miles.

The pilot project will be in Mil-

ton Keynes, with the first stage to have just three pods with trials starting in 2015. The second stage will be to increase the number of pods to around 40 to see how it works as a system before a large-scale roll-out.

A promise of investment in the road network came from Phil Proctor, principal intelligent transport systems advisor for the Highways Agency.

"There is going to be a new level of financial investment in the roads," he said. "We are going to get £15.1bn over the next five years. It will be the biggest upgrade of our network ever."

He said that the road network in England was one of the safest in the world given the amount of traffic, but he said congestion was costing the UK about £4bn a year. And the Department for Transport

was predicting a 44% growth in traffic from 2010 to 2035.

"We need to look at how we can move forward with new technology," he said. "We can't work on our own any more. V2x technology provides a real opportunity."

Jon Horsley, lead technologist for automotive at Innovate UK (formerly the Technology Strategy Board), said that automotive was undergoing wholesale change globally.

"Not in a hundred years has so much changed on a vehicle," he said. "This is being driven by emissions targets and changing customer demands. It is creating new challenges and opportunities."

He also said that end-of-life and recyclability were becoming prominent.

"There is a lot of value in the components," he said. "You don't want to send them all to the scrap heap; you want to get some of it back."

Robert Evans, chief executive office of Cenex, believes the automotive industry has never been so open to new technologies. Cenex was established in 2005 as the UK's first centre of excellence for low carbon and fuel cell technologies. Today Cenex operates as an independent not-for-profit consultancy specialising in the delivery of projects, supporting innovation and market development, focussed on low carbon vehicles and associated energy infrastructure.

"Once it was difficult to get heard by the motor industry," said Evans, "but now there are opportunities for developers of new technologies. They are hungry for technology that can lead to low carbon vehicles."

John Miles: "Things will stop working."

Phil Proctor: "We can't work on our own any more."

Robert Evans: "They are hungry for technology."

Focusing on critical safety modes

A simulation system for narrowing failure modes down to only those that will cause a serious malfunction was described by Chris Aden (above), product marketing manager for Synopsis.

"How do you know your design meets safety requirements?" he asked. "Not just what the system is supposed to do but what it is not supposed to do. You have to map all the failure modes to what the device is not supposed to do."

He proposed using simulation to verify that certain failure modes would cause malfunctions.

"We have a low-cost way to map the failure modes to the malfunction," he said. "We have tangible ways to see which failure modes will lead to which malfunctions."

For example, he looked at a steering system, which is an Asil D hazard. There are tens to hundreds of possible safety centred malfunctions and hundreds to thousands of failure modes, which could mean 100,000 safety scenarios.

"The system models we can create can simulate multiple hazards and malfunctions," he said. "In the steering example, the simulations show that only one of the faults leads to a hazard. Some others lead to malfunctions, but not to safety hazards. Engineers can thus save time by focusing on the failure modes that violate safety goals."

Cyclist detection

Tim Styles (right) from Aptcore described a cycle detection system for buses that has been on trial in Bristol and London since March and is about to go into production.

The system can recognise a cycle undertaking a bus and alerts the bus driver to its existence so that he or she doesn't make a manoeuvre that could endanger the cyclist.

Called Cycle Eye, it uses Aptcore ACR102 radar processing IP on a Xilinx Zynq FPGA.

"The system was detecting 98% of cyclists with only one or two false alerts per hour," said Styles.

Simpler code can be more secure

Security is the cloud hanging over the whole connected car vision, according to Tony Webb, field applications engineer with Green Hills Software.

"The state of security isn't exactly great," he said. "Security breaches are in people's minds. Criminals can be very innovative so it makes sense that security is a great concern."

He said that once someone had found a way into a car, they could have access to everything, and they don't need a physical connection as Bluetooth and cellular both provide entry points.

The trick he said was to minimise complexity.

"But is often much more difficult to write a simple piece of software," he said. "Software engineers tend not to write a few lines of code because it makes it look like they are not doing much. But if it is simple and elegant, it is harder to hack."

Other techniques include only giving access to resources that are needed.

"Don't give applications the

Tony Webb: "If it is simple and elegant, it is harder to hack."
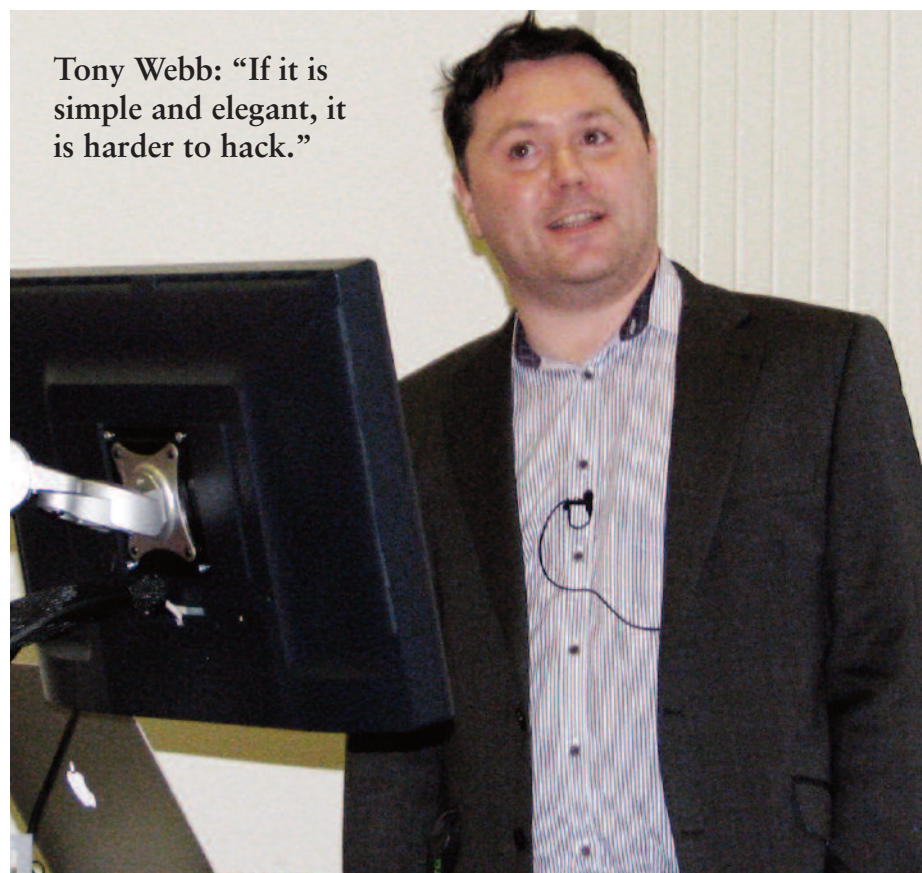
right to access all files, send network messages and so on," he said. "Build up systems from small components and go for a single engineer per component. Follow process to make sure everyone knows what is going on."

He also said to have the work validated by an independent external expert. "Don't mark your own work," he said.

Other things to be considered include secure boot, access control, authentication, encryption, firewalls and lifecycle management.

Researchers aim to reduce cost of electric powertrain

As the Vehicle Electrical System Integration (Vesi) project enters the final year of its four-year mission, project manager Leigh Murray from the University of Warwick gave an update on its progress. One of the main goals of the project is to reduce the cost of an electrical powertrain – which is more expensive than the powertrain in an internal combustion engine vehicle – by integrating functionality.

Using £3.1m ESPRC funding, the universities and industrial partners were split into six research teams working towards three demonstrators. The six teams are looking at power semiconductors, design tools, packaging, motors, converters and passive components.

The power semiconductor team at Warwick is growing layers of silicon carbide on a silicon wafer to develop 1200V lateral Schottky power diodes and 1200V lateral mosfets. The design tools team is exploring simulation software for power drive trains in electric vehicles, as well as heat removal techniques and liquid cooler design and simulation.

Packaging chips on a substrate rather than using wire bond and solder techniques could improve reliability, hopes the third team. The motors team is exploring alternatives to rare-earth permanent magnets to get round demagneti-

Leigh Murray

sation problems, expensive materials and limited supply.

The converters team is developing an integrated on-board battery charging system using single-phase, three-phase and multi-phase charging. And the passive components team is trying to improve the miniaturisation of wound components and inductor performance by using 3D thermal models.

"Work is ongoing and we are feeding this work into our demonstrator teams," said Murray.

The first demonstrator team is trying to build a high-performance ferrite motor. The second is integrating power conversion techniques for reducing EMI. And the third is constructing an integrated on-board battery charger.

"There is a lot of research being done at the universities and it is great that we have the support of industry," said Murray. "The project will finish in eight to nine months time."

Work starts on Naic

Delegates were given more details about the National Automotive Innovation Centre (Naic), which is being built on the University of Warwick campus. Building work has just started and aims to be completed by the end of 2016 ready for a 2017 opening.

There will about 1000 engineers working at the centre of which 600 will be from Jaguar Land Rover, which has invested about £51m of the expected £94m cost. The other 400 engineers will be from academia and the automotive supply chain.

"We are very proud to have the Naic on site," said Gunwant Dhadyalla (above), principal engineer for the Warwick Manufacturing Group (WMG), part of the University of Warwick. "It will be the biggest facility on site. It is fantastic for us."

Open source is disrupting market

The move to open source is causing disruptions in the automotive market place, claimed Andrew Patterson, business development director at Mentor Graphics.

He said that in 2011, open source accounted for just 9% of the market in automotive but by 2013 it had reached 19% and was still growing.

"It is a very fast growing sector of software," he said. "The move to open source is a new way of working for many OEMs and tier ones globally."

However, he said standards such as ISO 26262 were a long way from open source and so the challenge was merging these together.

"Drivers and passengers also have different needs, and we need to address both of them with connected car systems," he said. "We need to get real-time traffic infor-

Andrew Patterson: "Drivers and passengers have different needs."

mation into the vehicles. And we have to find safe ways of getting uncertified software, such as some

Dynamic improvement

An anti-lock brake and traction control functions developed by the University of Surrey can provide a significant improvements in overall vehicle dynamic performance. This is the view of Phil Barber (right) from Jaguar Land Rover talking about the E-Vectoorc (Electric VEhicle Control and individual wheel Torque On and Off Road Conditions) project funded by the EC.

The university had 11 partners in the project as it aimed to improve safety and comfort using vehicle dynamic simulation and hardware-in-the-loop combined with real on and off road testing.

"It is being used on different vehicle sizes and applications," said Barber. "And it reduces energy consumption. The aim is for it to be used in a larger European project."

Android apps, into the vehicle."

Within the vehicle, he said there had been a revolution in the way things were connected together. Ethernet has come into the car to handle multimedia. Autosar and Genivi are helping.

But as for open source, he predicted that Linux would dominate.

"Linux infotainment design starts are increasing," he said. "And the Genivi version of Linux is growing slowly. The market is standardising round Apple Carplay and Google Android Auto. Mirrorlink is providing open source options for Android."

For overall connectivity, he said Autosar was dominant and by 2020 there would be an Autosar ECU in every new vehicle. But he said there was a mistrust as to whether the separation between software within the car was secure.

Overcoming wire bonding problems

Packaging is a weak point in reliability for power semiconductors but the latest techniques for removing wire bonding are improving the situation, according to Andrew Stewart, senior global account manager at International Rectifier.

In electric vehicles, the devices are found in the three main power blocks – battery management, main inverter and DC-DC converter. The common challenges are removing heat, reducing size and weight, increasing reliability and keeping costs down.

"The ideal power semiconductor device allows current to flow with minimum resistance and inductance, and allows the heat to be

easily extracted," said Stewart. "But packaging is a weak point in reliability; it increases the cost and reduces performance."

He said traditional wire-bonded packaging had improved, but this improvement was incremental.

"This is stuff that has been in the field for a long time," he said. "It is time for something revolutionary."

He said the next generation would use solderable front metal technology, which can be used for mosfets and IGBTs up to 1200V and can handle die up to 225mm². It involves diodes and IGBTs mounted on direct bonded copper substrate.

"The user can mount these on

Andrew Stewart

whatever ceramic substrate they want," he said. "There is no wire bonding, so you eliminate yield loss due to wire bonding issues. It is a seismic shift in reliability as bond wires are the most common failure mode."

Virtualisation could be key in processor consolidation

The number of processing centres in vehicles will reduce as manufacturers combine processors into hubs and domain controllers, believes Chris Turner, product marketing manager at Arm.

"There are at least 100 silver boxes hidden around vehicles these days," he said. "I think the number of boxes will reduce as the vehicle makers combine them into domain controllers."

But he said there would still be intelligence at the edge, with the sensors and actuators. However, he said the boxes should not be considered as processors but groups of processors.

"When we unscrew these boxes, we will see a number of chips and within each chip a number of processors," he said.

The connected cars will also

Chris Turner: "Our goal is to do something useful."

mean a lot more information that needs to be dealt with.

"Once we have V2V and V2I radio systems installed in vehicle, we will start to get information not just from the car in front but from the cars in front of that," he said. "This means we will get a lot more information about what is going on, especially about vehicles braking."

Automotive, he said, was now

becoming more a focus for Arm, and he said this would grow with version eight of the Arm architecture as it will contain virtualisation capabilities.

"Our goal is to do something useful," he said. "Software development represents 10% or more of the cost of developing a vehicle."

Version eight was announced about a year ago but the processor IP that will implement it has not yet been released nor who will be the lead silicon partners that will take it into production.

"But we need people to know that it is coming," he said, "as they work on their own hypervisor solutions so they don't go off in the wrong direction or waste software development time. It will be another couple of years before it is in silicon."

BODY LANGUAGE

Stello Matteo Billé, Doriana Montella and Romeo Letor discuss the main trends and innovation drivers in automotive body electronics

Body control modules (BCMs) are becoming a necessity for car makers, for example, in the MQB platform being used by Volkswagen

The way the electronic systems in today's vehicles evolve is essentially the result of different requirements, which drive product innovation and the roadmaps of the semiconductor industry. The content of electronics in modern vehicles is continuing to augment the annual growth rate of global electronic systems demand in automotive – estimated to be stable at about 7% for the next five years; body electronics are forecast to experience basically the same growth.

Innovation driving factors can be clustered into four main categories – not always sharply distinct:

• Requirements of international standards and regulations: Applied to car gases emissions, electronic systems, and single component level;
• Application specific requirements: Includes the requirements for higher reliability, smarter diagnostic capability, and smaller dimensions and weight;
• Systems cost optimisation: Reduction of the overall system cost to improve the competitiveness and ease of design for further penetration of electronics; and
• New applicative domains.

Standards and regulations

Other than the well-known AEC-Q100 standard – which sets the minimum qualification requirements of electronic devices used in the automotive industry – electronic components must also comply with a huge number of additional regulations.

As a general consideration, these regulations each shape the development of the new product and impact the entire development cycle, from design rules through packaging technology, up to device qualification.

As an example, electro-magnetic compatibility is regulated by several specifications both in terms of electro-magnetic emissions and of immunity to disturbances. Some of these specifications are peculiar to car makers, others refer to international (Cispr and ISO) or geographical standards (SAE in North America).

International standards also set the conformance tests for Lin and Can transceivers whose certification is indispensable for guaranteeing – for instance – the
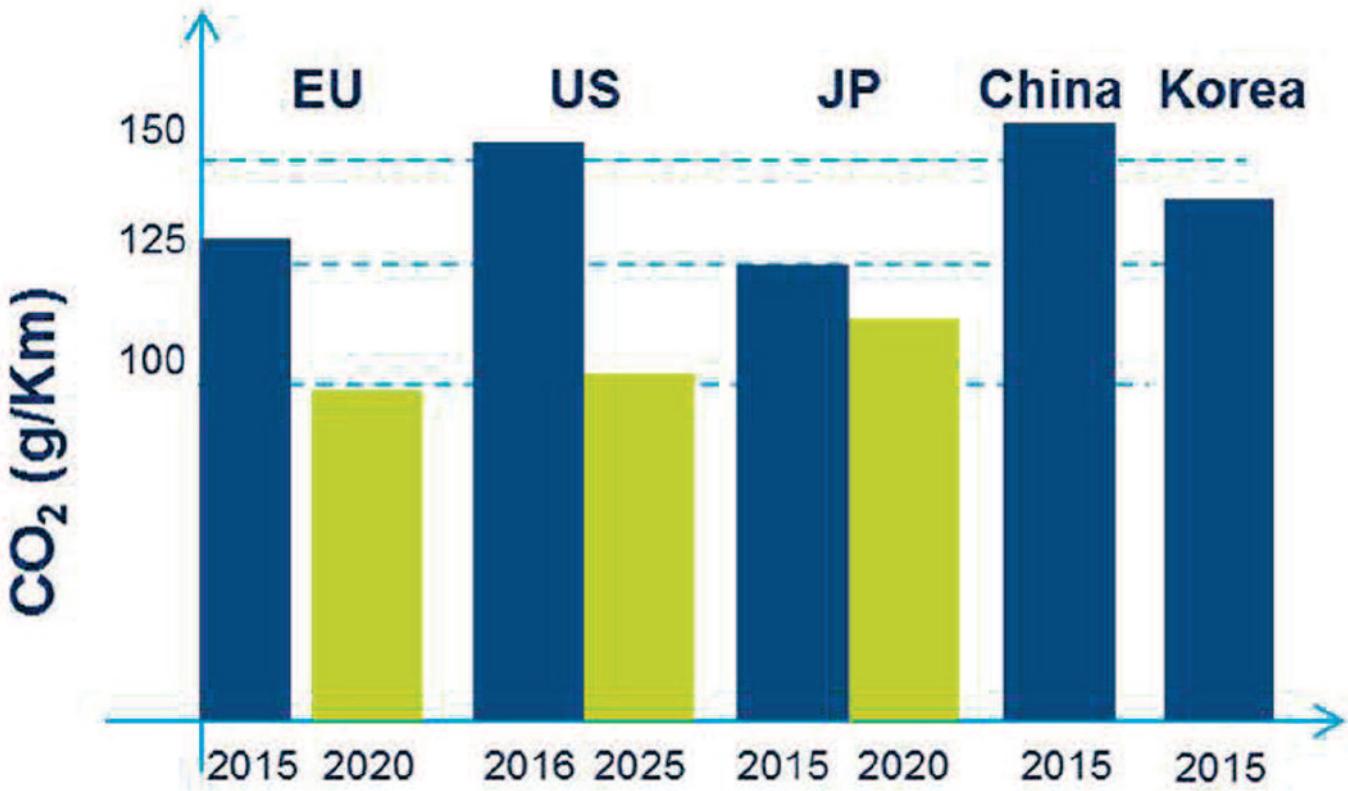
inter-operability of devices from different electronic suppliers.

Also, RoHS restrictions on the use of hazardous substances applied to electronic devices has required the elimination of lead from any electronic devices, forcing the development of new packaging technologies capable of combining the needs of miniaturisation efforts and higher power density dissipation together with respect for the environment.

What makes things even tougher is that the norms themselves evolve, thus obliging the semiconductor industry to align in one of two ways: the ones following the pace established by the new regulations; and the ones who – going beyond the pure norms – become an active part of the legislating community.

On top of those specifically applied to electronic systems and single components, world-wide local legislations that introduce limits on vehicles' emissions of both pollutant substances and CO_2 are modifying cars' architecture with regards to the supply of power loads and adoption of more efficient electronics.

Although these new standards especially impact powertrain systems where, for instance, what were belt-driven loads are now becoming electrically powered, and pumps and fans are run by highly efficient brushless BLDC motors, some influence is also seen in car body control modules (BCMs). As an example, the deeper penetration of solid-state intelligent power switches enables a significant saving in terms of wiring costs and weight: up to 50kg of cabling according to one report, resulting in saving up to
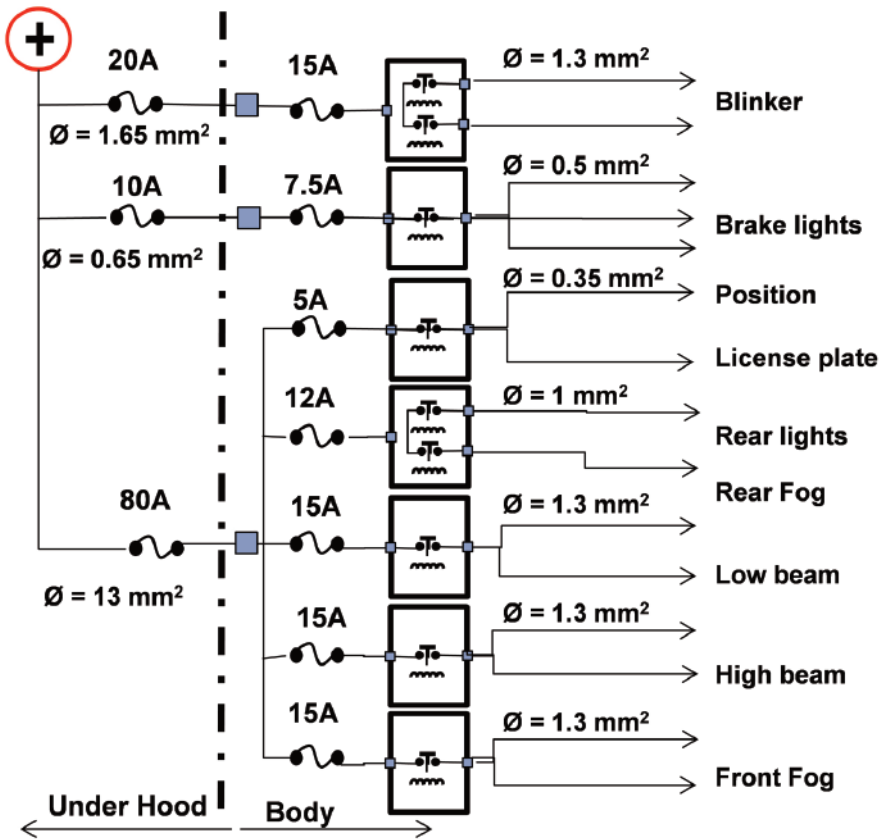

Fig. 2: Typical connections diagram for lighting systems using relays

3.5g/km of CO_2 emissions.

Application requirements

Led by such features as active and passive safety systems, enhanced human interfaces (head-up displays and touch screens for examples), and body convenience elements, the pervasiveness of electronics in the automotive market is forecast to continue increasing. In particular, because of the growing demand for higher quality and premium car sales in the Chinese market, the value of the electronics content per car in China is forecast to grow annually by a 3.5% average in the years 2013 to 2018.

As a natural consequence, body electronic systems are subjected to an incessant increase of complexity that challenges the elec-

tronic systems' architecture definition and design with application specific requirements and needs:

• PCB heat and power dissipation handling in a context where the number of loads increases and both the available space and target weight tend to decrease;
• Simplified diagnostics required for solid-state power switches to reduce the growth of both the number of connections on the PCB and the required resources to the application microcontroller;
• The optimisation and minimisation of the overall number of connections both between ECUs and between ECU and loads, to compensate for the copper content and weight increase linked to higher overall complexity;
• The optimisation and minimisa-

Fig. 1: Global comparison of light-duty vehicle fuel economy and GHG emissions standards (source ICCT)

Fig. 3: Typical power distribution box

tion of the wire harness section (and thus weight) again required to compensate for the copper content increase linked to the higher overall complexity;
• The reduction of the stand-by current; and
• Increased reliability.

Body control module
As mentioned, the number of loads managed by the BCM is increasing just as the requirements for BCM box weight and size are decreasing. This dramatically increases the power density the BCM manages, which in turn makes it extremely important to measure load power consumption and the temperature of the PCB and devices – with the final aim of keeping system performance under control. The task of monitoring both of those values requires a supervising application

microcontroller with very high computational power.

This means the PCB design can be made simpler due to the lower number of additional external components and needed interconnection on the PCB between control and actuation stages. The simplification of BCM thermal performances' optimisation is thanks to being able to perform a thermal map of the PCB through power devices during the development stage.

The soldering process may be verified after the modules' production. A smart power distribution may be implemented by selectively turning off selected loads in case of module over-heating. Real-time enhanced diagnostics even in off-state could provide, for example, anomalous warming of devices in off-state.

This also reduces the number of

connections and wire harness content.

An accurate design using electronic switches rather than electro-mechanical relays could use a wire harness up to two times thinner. The reduction in the number of fuses needed in the BCM also benefits the design process in terms of space and weight saving.

Consider the typical connections diagram for lighting systems using relays shown in Fig. 2.

To limit the number of fuses required, loads are normally clustered so that multiple loads are protected by one fuse. As an example, consider the two blinker lines. It's clear that to allow normal operations of all the loads at the same time, the fuse must be chosen so as to sustain the maximum amount of current. Due to this, and to guarantee that cables are protected by the fuse, the har-

ness itself must be properly chosen to sustain a short circuit current higher – in any conditions, for example, for any short circuit current – than the rated fuse current. For this reason, this process results in a cabling that is chosen based on the overall load and not on the single line load.

Clearly, the problem may in theory be resolved by using one fuse per load, but this would be demanding in terms of cost, weight and space, especially considering the afore-mentioned increase in the number of convenience loads per automobile.

Cost optimisation
Recently, the complexity of the BCM and the requested system functionality were limited to driving a few loads and basic diagnostic requests. Due to this, the pressure for system cost reduction was focussed on the mere cost of the silicon devices needed to drive the few loads. As mentioned earlier, this situation is quickly changing.

The number of loads driven by the body computers together with the pressing requests from car makers for better diagnostic and safety has increased the system complexity and moved the focus

of cost reduction onto the overall system cost of ownership, rather than on the pure silicon device cost.

For a given PCB size, it's clear that an increased module complexity needs higher integration inside the electronic components. For smart power switches, this trend is even more evident. Devices must integrate more and more intelligent functions – such as protection and diagnostics – while squeezing both the silicon and the package for overall PCB size, weight and cost reduction.

From the standpoint of the reduction of the overall cost of ownership, the support for the BCM is becoming a necessity for car makers, for example, the MQB modular transversal toolkit platform from Volkswagen. By enabling the re-use of the same PCB on different car's segments and models, the modularity reduces the costs of design, qualification and production, while improving the quality and shortening the development time.

Applicative domains
And, finally, another factor driving innovation is new applicative domains for body electronics. Other than the replacement of

halogen and HID lamps with LEDs, which is already considered a consolidated trend for the market, the introduction of electronic devices inside the power distribution boxes is considered the biggest opportunity for semiconductors beyond traditional perimeters.

Today's typical power distribution boxes, see Fig. 3, can contain up to 200 fuses and 30 relays resulting in 1.5kg pure hardware weight and not negligible physical dimensions. Additionally, the adoption of traditional fuses with related intervention time obliges the car maker to dimension the cabling based on fuse characteristics rather than nominal load.

To be successful in this market, the manufacturer must embrace this trend and own the necessary technologies to build its product line with dedicated features – such as low on-resistance, device in on-state in stand-by with low quiescent current consumption – and allow the replacement of both fuses and relays.

Stello Matteo Billé, Doriana Montella and Romeo Letor work for the automotive product group at ST Microelectronics

Fig. 4: Package size reductions over the years

MAKING IT CLEAR

## The Lexus NX is breaking new ground with surround sound digital technology

The Lexus NX marked the company's first entry into the mid-size premium SUV segment. It was conceived under the development concept of Premium Urban Sports Gear, much like high quality sports watches, bikes and fashion, as an edgy and emotional design to appeal to new customers who lead urban and active lifestyles.

The highly competitive mid-size sports utility vehicle market is one of the fastest growing in the motor industry. Globally, demand for mid-size SUVs has grown almost seven-fold in the past seven years and it is expected to top one million per year in 2015.

Lexus pioneered the premium SUV segment with the launch of
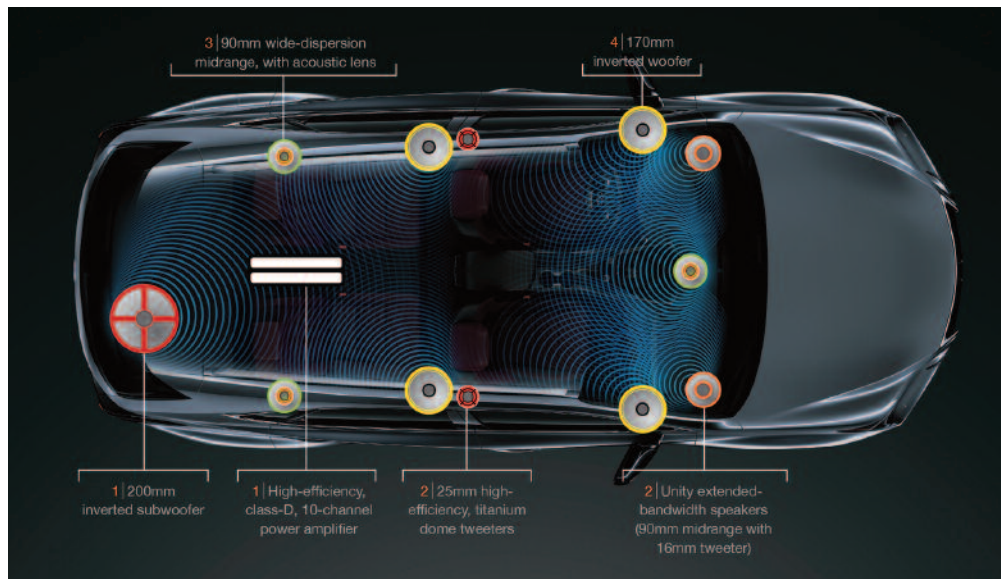
Positioning of the speakers in the Lexus NX

the RX in 1998. With the subsequent arrival of both the GX and LX, the company has gone on to establish a reputation for setting benchmarks in quality, design flair and advanced technology in the premium SUV and 4x4 markets.

Premiered in Europe in September, it was also the first vehicle to incorporate the Clari-Fi technology from Harman. Clari-Fi automatically analyses and improves the audio quality of compressed, digitalised music sources. The technology is part of the Mark Levinson Premium surround-sound audio system in the NX.

The audio industry has experienced a dramatic shift from vinyl LPs and CDs to compressed, digital files enabling the sharing of music across various mobile devices as well as streaming music services increasingly accessed in today's vehicles. The compression process has made audio more mobile than ever, but at the price of audio quality. Compressing audio files can discard up to 90% of the original audio content captured in the studio. As a result, consumers

cannot experience music in the way the artist originally intended. Clari-Fi is said to transform the listening experience back to a pre-compression era, by addressing this deterioration of audio quality by restoring what has been lost, to deliver a rich, uncompromised listening experience from any compressed music source.

Vehicle Electronics caught up with Etienne Plas, senior manager of product communications for Lexus Europe, at the European launch.

"In the course of the development of the new NX, Harman informed us about this new technology," he said. "Of course we were very interested in implementing it in the new NX and for it to be the first car to feature this technology."

Unlike other products in the market today, Clari-Fi does not simply add equalisation and boost bass, or focus only on leveraging high-resolution file formats on a proprietary device. It analyses digital audio signals in real time and rebuilds them during play-

back. It does not mask the effects of heavy compression by adding new effects, but instead uses an algorithm to put back what is lost during the compression process. The result? High-quality audio from compressed digital files from any playback source – including the car.

"Lexus' aim is to provide a high level of on-board well-being thanks to the use of advanced technologies that enrich the driving experience," said Plas. "Providing a premium sound system is an important part of this. However, people often listen to music from compressed digital files such as MP3, which offer limited audio quality. It's therefore very useful to have a technology that will restore audio quality to a superior level, hereby allowing the driver to fully benefit from the quality our sound system can deliver."

The Mark Levinson system uses the technology across 14 speakers in 12 locations, carefully designed and placed strategically through-

Etienne Plas: "We know our customers genuinely value the quality of the audio systems."

Inside the Lexus NX

out the vehicle cabin, to create an optimum listening experience. Powered by a ten-channel ML5 amplifier, the 835W audio system delivers high quality audio to driver and passengers alike.

"We know that our customers genuinely value the quality of the audio systems in their Lexus vehicles," said Plas. "We are confident that any technology that further enhances this quality will be fully valued by them."

Clari-Fi technology is already featured in Harman's JBL Authentics series of wireless home entertainment sound systems and will be incorporated in a range of home, multimedia and automotive products in 2015, but Lexus is the first automotive OEM to use the technology. Plas is pleased about that.

"When we are confident that a new technology brings added value to our customers, we are of course eager to implement it as quickly as possible in our vehicles," he said. "Lexus has a long-term relationship with Harman. We are very pleased with our ongoing collaboration with its engineers to develop high quality audio systems, each specifically

designed for our respective models."

As to the future, Plas said that there were plans to use the technology in other models.

"This will be provided on future Lexus models equipped with Mark Levinson systems, but we cannot yet comment on which model will receive this technology, or when," he said.

Dinesh Paliwal, Harman's chief executive officer, added: "We are proud to continue our 13-year partnership with Lexus, and excited that the new NX vehicle, which will be the first automobile in the world to feature Clari-Fi, will also be available on the Euro-

pean market. Clari-Fi is a significant technological advancement that transforms the listening experience for the millions of people who don't want to sacrifice quality for the convenience of downloaded and streaming digital music.

"We develop technologies that help recording artists realise their vision. We also want consumers to experience the music the way it was intended – whether at home, on the go or in the car. Now, drivers with the Lexus NX Mark Levinson surround sound system will have an unparalleled listening experience with the breakthrough Clari-Fi."

Start of production of the Lexus NX at the Miyata plant in Japan

Oh Misra C

Fergus Bolger explains the effects of the latest version of Misra C on software quality initiatives in automotive system development

Software quality is now fundamental to the automotive industry. All stakeholders, from top-level automotive manufacturers through multiple tiers of component suppliers, need to give quality assurance to their customers along with delivery of high-quality and compliant systems and components. With the release of Misra C: 2012, the pre-eminent coding standard for the automotive world continues to evolve as a sophisticated and robust containment of the C language.

In parallel to this, approaches adopted on a more regional basis to achieve software quality are becoming more mature, witness the Japanese industrial and regulatory bodies' engagement in finding ways to relax in a highly controlled fashion the strict guidelines of these self-same Misra coding rules. Reflecting the increasing complexity of the embedded software domain, automated tooling for checking and monitoring software quality is growing more sophisticated and serving a wider community of stakeholders.

The automotive sector has for many years been on a quality-improvement mission. Driven by the proliferation of software applications residing in the average car, and the enormous growth in the size, volume, interaction and interoperability of these pieces of software, the challenge has been to place all this development in a controlled and robust quality environment. OEMs and suppliers need to ensure they have better visibility and control over the quality of all the software and are increasingly relying on the use of tools and coding standards to help give quality assurance to their customers and avoid the risk of costly recalls and delays in development.

Quality

Today the automotive industry has the twin standards initiatives of the ISO 26262 functional safety standard and Misra C coding standards that jointly represent a solid basis for setting software quality goals in the sector.

Ratified relatively recently (November 2011), ISO 26262, which is an adaptation of IEC 61508, addresses functional safety in passenger car production, and has been widely adopted by the whole automotive industry. It mandates the use of strong defensive coding standards such as Misra C.

The Misra C coding rules, which can be deployed either as a subset or in their entirety, have already become the de-facto standard since their introduction in 1998 and recent second revision in 2012. Misra C is used within organisations' development groups and between suppliers, contractors and customers to ensure code quality and compliance.

The new revision of Misra C primarily supports the use of the C99 standard of the C language as well as C90 with the additional benefits that brings for software developers who can now exploit C99's enhanced features in data handling in their products. By adding C99 support, the standard has been updated with new rules, improved explanations and definitions to ensure correct containment of the C language to ensure compliance with the standard.
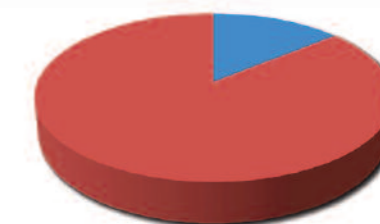
Stakeholders

Different stakeholder groups often have a different perspective and approach to software quality. However, in an increasingly diverse software ecosystem it is a necessity to share a common basis for

Misra C: 2012 guidelines

A brief history of Misra in the automotive industry

The genesis of automotive software began more than 15 years ago, when automotive engineers switched from mechanised control to software-based, first with assembler and then quickly progressing to the C language. The popularity of C as the language of choice was based on the availability of trained programmers and the language's high flexibility.

Recognising the difficulties and pitfalls of the C language, especially for automotive engineering groups with more mechanical than software expertise, an initiative to address this was started by the Motor Industry Research Association. It sponsored an expert committee that comprised industry and software tooling companies to produce the first public C coding standard, Misr-C (1998).

Starting as a UK initiative, it quickly reached the global automotive sector, and in fact soon transcended industry lines into many different non-automotive applications. There have been two successors to this initial standard, a 2004 and most recently a 2012 update of the original Misra C standard, reflecting the pervasive interest and adoption of this successful initiative.

Along with adoption of strong defensive coding practices, the automotive industry addressed functional safety with a new ISO standard 26262, as an adaptation of IEC 61508. This standard, ratified in November 2011, applies to automotive passenger car production, and has been widely adopted by the automotive industry. It mandates the use of strong defensive coding standards such as Misra C.

Comparisons between the 2004 and 2012 versions of Misra

CLASSIFICATION SUMMARY		DIRECTIVES (16)	RULES (143)
Category	Advisory	7	32
	Required	9	101
	Mandatory	0	10
Language	C90	0	2
	C99	0	11
	C90 or C99	16	130
Decidability	Decidable	-	117
	Undecidable	-	26
Analysis Scope	Single Translation Unit	-	104
	System	-	39

Some rules are now classified as "mandatory"

Some rules are only relevant for a specific language version

Some rules cannot be statically enforced with certainty

Rules that can be enforced within a single translation unit are decidable

Summary of the Misra C: 2012 guidelines

measuring quality.

For senior managers in automotive companies, quality is heavily influenced by regulatory demands and fiduciary responsibility, and monitoring quality has become as important as cost and schedule. What is needed at this level is an overall picture of software quality, a common and consistent measurement standard, and a trend line for current and past projects with particular focus on upcoming release milestones.

Software engineering groups need a more detailed and in-depth quality focus, but crucially one that matches this top-line measurement.

For project leaders and managers, the detailed state of compliance to the applicable standard and overall quality goals must be readily available, broken down by developer and project.

For developers, quality tooling must integrate right into their software development environment and produce precise quality advice relating to the latest code changes.

The quality assurance group has often had to rely on external lag metrics such as testing failures and bug data collection. What they really need is a quality system focussed on true leading measures such as detailed coding compliance, code complexity measures and other inherent software quality artefacts.

Deployment pitfalls
There are a number of common pitfalls when deploying a quality system:

• Something that works for a developer on isolated code might not adequately scale up to entire projects and throughout the organisation;
• Analysis must yield near-zero false positives – all diagnostic output must reflect real addressable conditions;
• Likewise, no area of quality conformance should be ignored or missed – every coding rule must be addressed with meaningful diagnostics;
• Real-world limitations in the

achievement of full compliance must be recognised – sophisticated and controlled deviation from rule adherence is needed; and
• Visibility at higher organisation levels must match the detailed low-level compliance efforts – any disconnect between stakeholders will lead to disenfranchisement.

Recent trends
The automotive sector has seen dynamic growth in software use over the past decade, and recently we are seeing some quite profound trends in the area of quality attainment and focus.

While analysis tools have historically been applied in a validation and verification mode once the code has been written, in recent years there has been a strong drive for more upfront use by developers as they write the actual code; a clear manifestation of prevention being better than cure. This is firstly coming from users demanding that suppliers demonstrate upfront compliance to industry best practices. And, secondly, from the diverse and distributed contributors to predominantly software-based components who want to reduce the disruptive rework impact of non-compliant code.

An interesting extension to the principle of deviation to full compliance is underway in Japan. The industry is coming together to organise a tightly controlled set of deviation cases from full Misra compliance. Each case where a deviation is to pertain must be agreed and its rationale, safety case and other background information stated upfront. Only the

Fergus Bolger

set of agreed deviations would be permitted to apply across the Japanese automotive industry, which marks an extension in sophistication in coding compliance. Therefore, companies supplying globally would need to be able to validate their code base for individual market conditions.

Automated tools
Static analysis, the key ingredient for achieving code quality, is an integral part of the development environment. Extending it across the enterprise requires an approach that recognises different levels of user engagement.

The facilities needed in a good quality management reporting system include:

• Review of diagnostic output, provided to an audience outside of the development environment, is a strict necessity;
• Exploring underlying non-compliances and code bugs promotes greater collaboration between stakeholders;
• A key capability is the presentation of trend charts of project-

level metrics covering compliance, complexity and other suitable measures yielding cross-project comparisons and pre-release warning signals; and
• Advanced collaboration features can include annotation of coding decisions and common understanding between all appropriate stakeholders, and a deep-rooted code inspection environment backed up by sophisticated exposure of source code details.

When embraced, this holistic approach to testing using automated tools promotes a higher level of productivity, code quality and code reuse, which in turn will lead to faster time to market for new projects and reductions in overruns and rework.

Summary
The automotive sector is enjoying a period of rapid growth and sophistication in software applications. There is recognition of the need to match functional enhancements with quality initiatives, and to ripple this philosophy out through the supplier chain. Recognising the pitfalls in deployment of such a system, the answer is to be found in sophisticated and capable automated tooling that delivers quality analytics to all stakeholders.

Fergus Bolger is chief technical officer at PRQA

What's new in Misra C: 2012

• **Language versions:** Support is now provided for C99 as well as the C90 standard.
• **Rules:** 11 new rules have been introduced to curtail the usage of some potentially dangerous C99 language features.
• **Rule classification:** The addition of a new mandatory rule class. These are non-negotiable rules whereby deviations are simply not permitted.
• **Rule compliance and enforceability:** Enhancements to ensure that, wherever possible, rules are amenable to automatic enforcement.
• **Improved rule definition:** More rigorous definitions with comprehensive explanations and rationales.

Keeping it simple

Cloud-based computer-aided design tools are helping bring a revolutionary car from idea to production

The effects on the environment of transportation has become a major influence in designing modern vehicles. But one company is taking this to new lengths. This is Riversimple, a company set up with the sole purpose of eliminating the environmental impact of personal transport.

As such, the company has designed a car that should be available next year that emits nothing but water yet will be capable of doing the equivalent of 70km/litre, about 200mpg.

"We're designing a radically new car, which will be in market trials late next year," said David Rothera, vehicle electronics engineer at Riversimple. "It emits nothing but a tiny amount of water and will do more than the equivalent of 200mpg."

The UK-based business has as its chief designer Chris Reitz, who has assembled a design team in Barcelona. Reitz was the original designer of the Fiat 500. Many team members have worked in Formula One.

The car is said to break new ground in fuel efficiency and environmental performance. It's powered by a hydrogen fuel cell, and has been designed from

The technology demonstrator achieved the equivalent of 300mpg

scratch with lightweight but strong composite materials. It weighs less than half as much as a conventional car, and is highly aerodynamic and stable.

The technology demonstrator, which is on display in the Atmosphere gallery of London's Science Museum, achieves the equivalent of 300mpg and emits nothing more than a teaspoonful of water on long journeys.

What will also be different about Riversimple is that the company will not be selling the cars, rather offering what it calls mobility as a service.

Customers will pay a fixed monthly fee for the car; the fee will include fuel, insurance and maintenance.

"We believe that this leasing-rather-than-buying concept could change how the world uses and values its reducing resources," said a Riversimple spokesperson. "It aligns our business interests with the environment's. That is why we are adopting it right through our supply chain and are pushing for it to be adopted in other industries."

How the car works

The car uses what the company calls a network electric platform. There are four electric motors, one in each wheel. Each motor is capable of regenerative braking to generate electrical energy when the brakes are applied. Super capacitors store this energy and provide most of the power for acceleration.

Low-powered hydrogen fuel cells and a body made of lightweight composites give the efficiency and range that would not be possible from just inserting the fuel cells into a conventional vehicle.

Decoupling acceleration and cruise power requirements means the fuel cell needs only to be sized to meet the maximum steady demand when cruising. This is usually only about 20% of the maximum power required when accelerating.
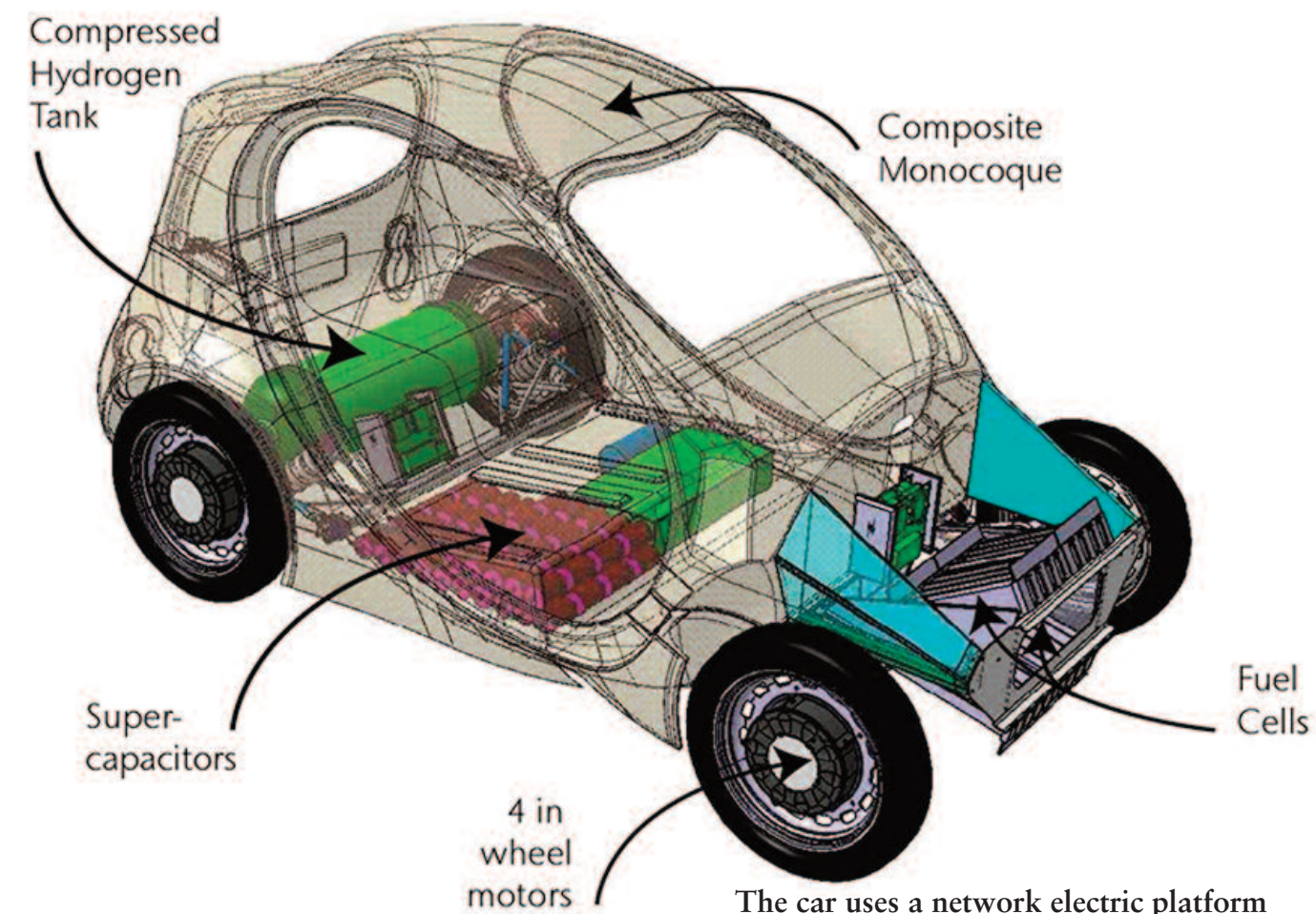
In a conventional car, the engine provides the power for acceleration and cruising; but as a car is only accelerating for about 5% of the time, and the power needed then is five times what it is when cruising, it means that for 95% of the time the car is carrying around an engine and transmission that is five times larger than necessary.

In this electric vehicle, almost all braking is done by the electric motors, capturing the energy of the car in motion, rather than using conventional brakes that just waste the energy as heat. This energy is then stored in a bank of super-capacitors. Because super-capacitors can be both charged and discharged very rapidly, they can provide 80% of the power required for acceleration. Therefore, only a fifth of the power is required from the fuel cell that would be required if it alone was replacing the engine in a conventional car, which leads to a large reduction in its cost.

Mass decompounding is an emergent property of whole system design rather than attempting to squeeze a fuel cell into a car architecture that is designed for a combustion engine and then trying to persuade it to behave like one. The reduced size of the fuel cell, and elimination of a gearbox and driveshafts, results in weight reduction. This leads directly to a lighter chassis, as this is usually designed to hold on to a heavy engine and gearbox in accidents.

This in turn means less power is needed, which means lighter components, and so a lighter chassis, meaning less power and so on, and this effect is magnified by using lighter materials, composites, for the chassis as well. Furthermore, all these weight reductions lead to narrower tyres and make power assisted systems for brakes and steering redundant; this virtuous circle of mass decompounding leads directly to

Fig. 1: Arcadia wiring schematic shown running in a standard web browser

The car uses a network electric platform

significant improvements in efficiency.

Design tools

Riversimple adopted the Cadonix Arcadia cloud-based automotive harness cad tools to develop the road-going version.

"The Arcadia tool is excellent in several respects, but what really stands out is the enthusiasm and support of the Cadonix team," said Rothera. "This will be key for us as we address the very specific challenges of creating a ground-breaking vehicle and delivering it on time."

He cited the tight integration between the circuit design and the harness tools as a strong point for Arcadia.

"Cloud based design is new for us," he said, "but even at this early stage we've come to appreciate the flexibility of being able to access the design from anywhere."

Research and development of the two seater vehicle is taking place in Wales. The team is aiming for a fuel efficiency of more than 70km/litre, a range of 480km, 0-48km/hr in 5.5s, and a cruising speed of 88km/hr. The lightweight composite body is key to achieving this performance, but inevitably makes the electrical design more complex as it does not offer a return path.

"Arcadia is a flexible and intuitive tool, which will be fully able to address the need to include a return path, and other issues specific to the design of this unusual vehicle, said Rothera."

Andrew Armstrong, managing director of Cadonix, added: "Riversimple is developing a pioneering vehicle which may well set the tone for the automotive industry of the future. We are proud and delighted that they have chosen the Cadonix Arcadia environment for their hydrogen cell powered car. We look forward to working with them on this project."

Arcadia is a software tool providing schematic design, animated circuit simulation and analysis, electrical networking, harness design and full design rule checking for wire harness layout and manufacture. Using the integrated simulation capabilities, engineers can ensure their design intent is carried through into the physical implementation. It interfaces with the most popular 3D mcad and enterprise wide PLM and ERP tools, allowing projects to transition easily and smoothly into manufac-
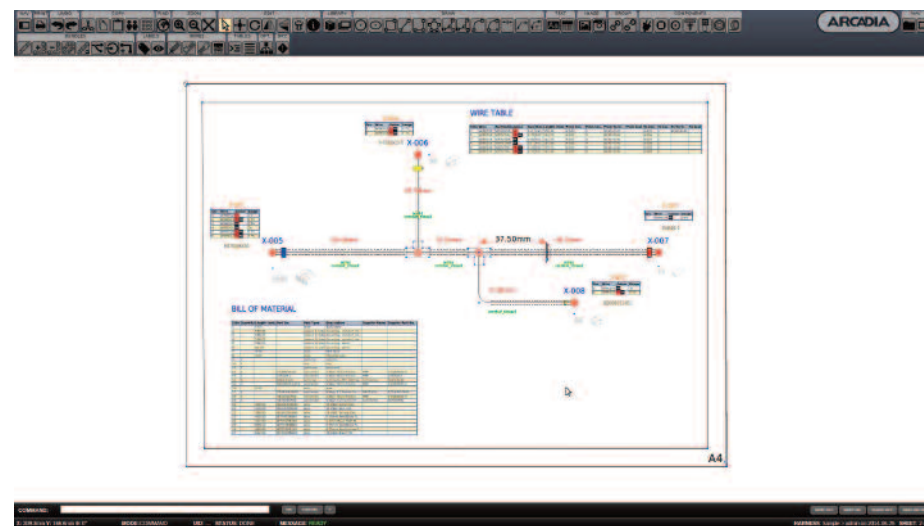
Compressed Hydrogen Tank

Composite Monocoque

Super-capacitors
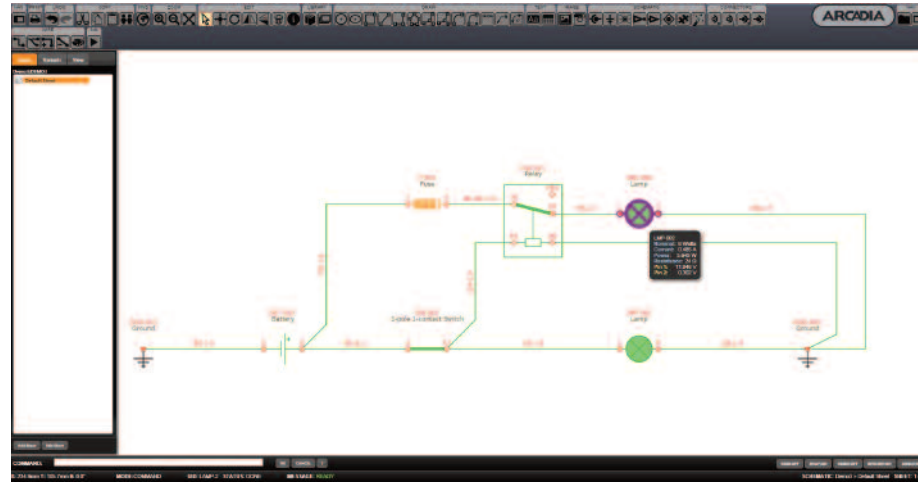
4 in wheel motors

Fuel Cells

Fig. 2: Arcadia schematic provides real-time schematic simulation

ture. Users can import databases and designs from many legacy systems.

How Arcadia works

A key advantage of cloud technology is that it lowers the dependency on capabilities of both the designers and their workstations. All the processing power that is needed for schematic routing and simulation, harness design rendering, database operations and reporting is at the server end. High-bandwidth networking means users only need a modern web browser to send commands to the server and respond to its outputs, see Fig. 1. This platform-agnostic approach means harnesses can be designed on any desktop, laptop or mobile device, anywhere that has an internet connection. There is no software needed and designers can log in and work from the office, at home or anywhere.

Designers using cloud-based cad can tap into a lot of computing power from the server. For example, Arcadia delivers schematic design, animated circuit simulation (see Fig. 2) and analysis, electrical networking, harness de-

sign as well as full design rule checking for wire harness layout and manufacture. Users can select from around 12,000 components in the standard database and import many thousands more from their existing data and newly created catalogues.

Cloud-centric cad provides virtually limitless storage, allowing designers to monitor the ever-expanding range of connectors, fuses, switches and other circuit components coming onto the mar-

ket. Bundles can be created in the harness editor, either from existing schematics or as new designs. Sleeves, connectors, terminals and seals can all be incorporated. Legacy designs from older software can be incorporated into the system, complete with their bill of materials and component data.

Integrating schematic layout with electrical simulation lets the user verify harness designs, checking voltages at any node and ensuring that components are performing well inside their limits. A set of reporting options helps new and modified designs satisfy statutory scrutiny, see Fig. 3.

Conclusion

Computer-aided design has become an increasingly important factor in improving quality, driving down costs, lowering time-to-market and maintaining a competitive edge. As Riversimple has shown, emerging cad technologies are set to raise the bar even higher: to the cloud, in fact.
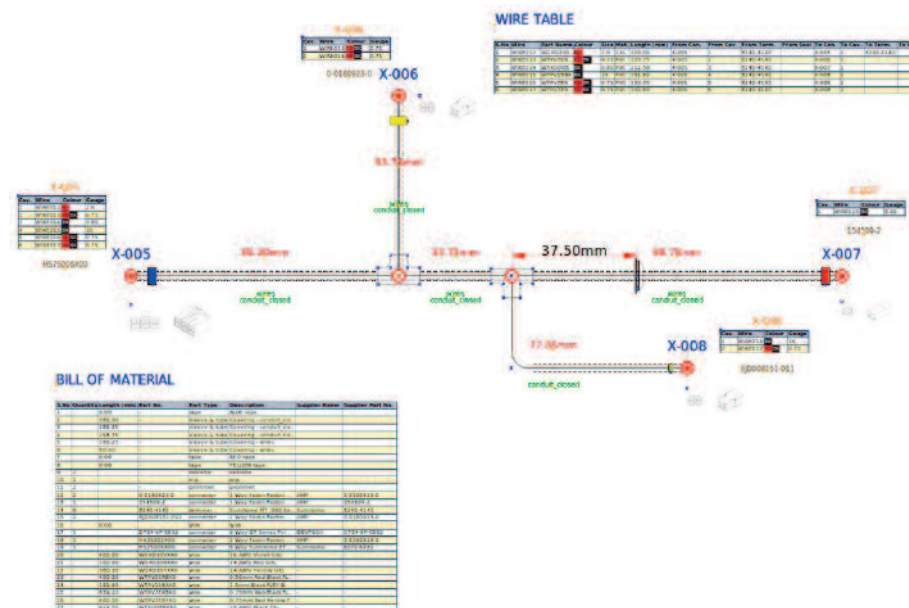

Fig. 3: Wiring harness design on Arcadia showing wire table and bill of materials

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VEHICLE electronics

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DOING THE MATHS

Steve Rogerson reports from last month's Matlab Expo held at the Silverstone racing circuit

Marta Wilczkowiak

Andrew Bennett

Graham Reith

Call for collaboration

There were a lot of calls at the conference to take advantage of Matlab's ability to allow collaboration on projects.

"It's about collaboration," said Graham Reith from Mathworks. "Usually many engineers are involved in different parts of the design flow. It is rarely one person." He said each person could bring valuable expertise from their discipline.

"Model-based engineering helps," he said. "Model-based design gives greater confidence that you are going to have effective product."

Mathworks senior application engineer Marta Wilczkowiak pointed out: "There is no such thing as perfect code. Let's think what the world will be like if we all collaborate."

And Andrew Bennett, principal engineer for Mathworks, added:

"When you are working with large models, you need to look at how you can partition the modelling so multiple people can work on it at the same time. Different people can work on the files independently of each other."

From cars to cows

Connectivity, algorithms, low-cost hardware and people computing everywhere are the main forces driving innovation and engineering today, believes Tanya Morton, application engineering manager at Mathworks.

"Connectedness is a significant transformation, especially in modern cars," she said. "We are seeing more of the cars connected together in traffic flow applications."

But she said the four main changes of connectivity, algorithms, low-cost hardware and computing everywhere were all linked to each other.

"Algorithms are in everything," she said. "Algorithms are the brains of the smart systems that are around today."

But she said the "incredibly exciting area" was the growth of low-cost hardware such as Arduino, Raspberry Pi and Lego Mindstorms EV3.

"These low-cost devices are really fuelling innovation," she said. "They are making engineering more accessible. It is hardware for the masses."

She said a good example of how these elements were working together was the growth of the internet of things.

"There is even an internet of cows," she said. "They have electronic sensors in their ears to monitor their position and health and even show when they are pregnant."

But all this generates data.

"Big data such as this exist in every industry," she said, "including automotive. Fleet data will influence vehicle design."

Tanya Morton: "There is even an internet of cows."

How motor racing technology is improving London buses

Moving from helping top racing cars to London buses was achieved using the versatility and flexibility of Matlab and Simulink, said Rick Townend, technical director for GKN Hybrid Power. The company, which started in 2007 as Automotive Hybrid Power, has developed flywheel systems for Porsche racing cars as well as the Williams Formula One team. It was also used on the Audi E-Tron Quattro, which won the Le Mans 24-hour race three years running from 2012 to 2014.

"Our systems are electrically rather than mechanically linked and all our systems use basically the same architecture," said Townend. "We moved into the bus business in 2012."

This followed a simulation programme started in 2010 to look at ways of saving fuel in the real world outside of motorsport.

"We were working with Jaguar on a project and developed a model for a hybrid car," he said. "This started a programme of modelling and simulation. The key is to understand the engine. Petrol

Rick Townend: "It underlined the importance of doing the simulation first."

and diesel engines have very different behaviours. We did this with Simulink."

Another key part of the work has been the trend towards downsizing engines, and this involved a study of Range Rovers with 3.0 and 2.2 litre engines.

"From 2012, our focus has been on the bus market," he said. 'We did a fuel simulation using data from Can on a non-hybrid

bus to gather vehicle specific parameters such as gearbox ratios and engine fuel maps. It gave us the opportunity to look at the refit market for existing buses. So we did the mapping to hybridise buses without disrupting the existing transmission."

The company has had a bus running in London since December last year to correlate the reality with the simulation.

"We analysed a number of bus routes through London," said Townend. "The vehicle has a telemetry system so we can track it in real time. Not all the results were as

expected, but it underlined the importance of doing the simulation first."

Work is continuing at the firm, which was taken over by GKN earlier this year, concentrating on model simulation. A tricky area has been the effect of hills on a bus' performance.

"Hills were not considered on the original simulation," he said, "but they have a great impact on buses in the real world."

The firm is using Matlab for general data analysis and Simulink for system-level and vehicle-level modelling.

Automotive engineering needs to match rapid pace of change

The automotive industry has never seen anything like the rate of change that has happened in the past five years, according to Andy Richardson, head of simulation at Jaguar Land Rover (JLR).

"The pace of change in vehicle technology is astounding," he told delegates, "and this impacts on the engineering challenge."

He said JLR was planning 50 new products in the next five years across 178 global markets.

"Economy, safety, handling and performance are all key drivers," he said. "There is a massive increase in system complexity with 100 ECUs and 100 million lines of code in the new Range Rover."

As is common, the engineering team at JLR use the V model for designing new vehicles, using the left-hand side of the V for the customer experience and design details and the right-hand side for verification and validation of the design.

"This provides us with safety, quality, usability and economy," said Richardson, "but it doesn't give us the character of the car. Seductive

Andy Richardson: "The most important component is the driver."

design has always been a trade mark of Jaguar. Land Rover is different; it is about inner strength so you know you can trust and rely on your vehicle."

For the future, he sees the direction being more connectivity and the move towards autonomous vehicles.

"This involves a lot of systems that need to start talking to each other and working together," he said.

Model-based design, he said, was at the heart of how the company worked, starting with the fundamental requirements and then using

loop, full vehicle hardware in the loop and then vehicle in the loop.

"But the most important component is the driver," he said. "You need to understand how the behaviour of the driver affects the system. We all drive differently and introducing the driver into the loop is key."

These, he said, made sure the system and algorithms were robust when introduced into the real world.

"You have to do this with speed," he said. "We have to engineer the systems quickly. The design has to be robust to every potential error state. Getting the right data is a challenge."

model in the loop, software in the loop, component hardware in the loop, system hardware in the

Oxford University aids Formula One team

One of this year's Formula One teams has been getting help in handling the new hybrid technology from Oxford University in a project partly funded by the Engineering & Physical Sciences Research Council.

"For the 2014 F1 powertrain, the FIA came up with a load of rules that had to be followed," said David Limebeer, a professor at the university. "The key component was a six-cylinder downsized engine."

The cars also use two separate energy recovery systems, one for kinetic energy similar to what they previously had plus one for thermal energy

from the exhaust gases. On top of that there is a limit both in the total amount of fuel they can use and the rate at which the fuel is consumed.

"The first thing is to have models of the tracks," said Limebeer. "We have gone for full 3D modelling. We used the concept of a ribbon to describe the track."

One track that was modelled was Spa-Francorchamps in Belgium, and the hilliness of this proved interesting.

"There is almost a megajoule of potential energy between the highest and lowest points of the track," he said.

Modelling the cars in-

volved a combination of standard Newtonian mechanics, closed kinetic loops for the suspension system, aerodynamic maps and tyres models.

"The position of the car relative to the road has a big effect on the aerodynamics," said Limebeer. "We have all these modelling components joined together. We can also compute the optimal racing line."

He said the researchers calculated the optimal control for thermo-electric powertrains using Matlab software and tools. This allowed them to get like-for-like performance using only two-thirds of the fuel.

David Limebeer: "We are getting like-for-like performance with two-thirds of the fuel consumption."

But which team is benefitting from this? Limebeer wouldn't say. "We have done this work with one of the Formula One teams," he said, "but we can't tell you which one."

Matlab and Simulink updated to add capabilities

The talk of the show was Mathworks' introduction of release 2014b with a range of new capabilities in Matlab, including graphics and big data, and options in Simulink for accelerating model building and running consecutive simulations.

The added Matlab capabilities include a new graphics system, increased support for big

data, features for packaging and sharing code, and source control integration.

Added functions for processing big data on the desktop can scale for use with Hadoop. There is now Git and subversion source control integration and access to projects on Github from file exchange.

Toolbox is packaged as

single, installable files for easy sharing and downloading of custom toolboxes. There are date and time data types with time zone and display options.

Arduino and Android hardware support is available for interacting with motors and actuators, and for accessing sensor data. In the production server, there are client libraries for use with C/C++ and

Python environments.

In the statistics toolbox, there is a multiclass machine-learning framework for binary classifiers such as SVM, and for generalised linear mixed-effects models.

The data-feed toolbox has Bloomberg B-Pipe and Thomson Reuters Eikon connectivity. Added to the image processing toolbox are image

segmentation app, region analysis app and C code generation for 19 functions with Matlab coder.

The report generator fills in the blanks in Word and HTML forms.

The added features in Simulink allow for the running of faster consecutive simulations and accelerating model building.

The DSP system tool-

box has Arm Cortex-A code generation with NE10 support with embedded coder, and multistage sample-rate converter.

The embedded coder has been given Autosar target updates including 4/1 ARXML, client-server with Simulink functions, and multi-instance components and IFL/IFX libraries.

Design software makes Euro debut

Last month's Engineering Design Show in Coventry, UK, provided Altium with the opportunity to give the first European showing of version 15 of its Designer PCB design software. The version will be available in mid-November.

One of the key changes in Designer 15 is the improvement made to high-speed routing.

"There has always been a problem with matching lengths from driver to receiver which go through series terminations," said Robert Huxel, industry specialist with Altium.

Designer 15 can enable accurate length and phase tuning across termination components and enable

Robert Huxel (left) and Elmar Dukek

length, phase and delay tuning over the entire signal path. This means designers will no longer need external software outside the design tool nor will they need to maintain complex lists of signals and nets but instead be able to plan and route groups of high-speed nets more efficiently.

"We have also put together all the information needed to take a product to manufacturing," said Huxel. "In the past, if you wanted to manufacture a board, you had to create different files for the board and for the drilling, in formats that were old. PCB technology has moved on. Doing it that way can lead to errors. Manufacturers have been asking for this change."

Designer 15 introduces support for IPC2581 and Gerber X2, keeping designers up to date while giving a choice to broaden their selection of PCB fabrication partners.

"We have made the tool more user friendly and have improved the quality," said Elmar Dukek, value added resale manager at Altium. " The new version reduces error rates."

Support for Autosar based on rtos

Green Hills Software is providing support for Autosar application development, debug, execution and deployment based on its Integrity real-time operating system. It is a processor vendor neutral method for combining legacy Osek, legacy Autosar and new Autosar applications and services safely and reliably into a single ECU.

The integration with Autosar development and run-time environments delivers safe separation,

debug and execution of Autosar applications while combining Autosar applications at different Asils and even from different Autosar vendors. This approach provides independent and complete memory and time protection while being able to combine multiple SC1 applications onto a single ECU.

It includes the Integrity separation kernel, Multi integrated development environment, Autosar vendor integration com-

ponents, and software and services compliant to safety standards such as ISO 26262, IEC 61508 and EN 50128. Also on board are EEMBC C/C++ compilers and complete tool chain that leverage the Neon media processing engine and floating point units, integrated code quality tools including Misra C/C++ and Doublecheck static analyser, and multi-core runcontrol, board bring-up, low-level debugging and real-time trace debugging

with the Green Hills Probe and Supertrace Probe

"With this approach to next-generation Autosar-based ECU design and development, Green Hills continues its leadership in enabling the automotive OEMs and tier-ones to develop the most sophisticated, safe and reliable automotive electronics without compromise," said Dan Mender, vice-president of business development at Green Hills Software.

Axial caps

Axial capacitor versions of Kemet's surface mount X8L and X8R dielectric platforms have been introduced to make them suitable for high vibration environments, including under-the-bonnet automotive applications.

The Aximax X8L is a conformally coated device designed to operate in temperatures up to 150°C with capacitance up to $2.2\mu F$ and rated voltages up to 50V.

For applications sensitive to capacitance changes such as filters, the X8R exhibits no capacitance loss with respect to applied DC voltage and negligible loss as temperatures approach 150°C. These devices are available with rated voltages up to 200V.

Typical uses include decoupling, bypass and filtering in extreme environments such as down-hole oil exploration, under-the-bonnet automotive and mil-aero.

Both are lead-free, RoHS (without exemption) and Reach compliant, and are available in commercial and automotive (AEC-Q200) grades.

SoC and board target entry-level cockpits

As the latest member of Renesas' R-Car series for automotive, the E2 automotive systems-on-chip and R-Car E2 software development board are said to deliver optimised infotainment and display audio for entry-level integrated cockpit systems that support smartphone interoperability and, in combination with other R-Car devices, help achieve the scalability required to bridge the full range of integrated cockpit systems from entry-level to high-end models.

The CPU configuration consists of dual Arm Cortex-A7 cores and a single SH-4A core. This is said to deliver about four times the performance of the R-Car E1 for the entry-level range and provide a comfortable performance margin. The E2 also eliminates the need

for heat sinks and fans.

By raising the bus frequency of the connection to external DDR memory, the devices achieve ample performance using a single external DDR module and a 16bit connection.

The A7 core is binary-compatible with the A15 core used in the high-end products and the functional IP modules and memory maps are also identical. This allows use of the same drivers and middleware. System manufacturers can develop and maintain a unified software stack, and the use of a single platform in this way reduces development costs and development time.

The software development board has functions for application and middleware development by partner vendors. It suits creating features for the display and audio systems, such as smartphone interface, rear-view camera and media players.

Samples of the SoC are available now. Mass production is scheduled to begin in June 2016.
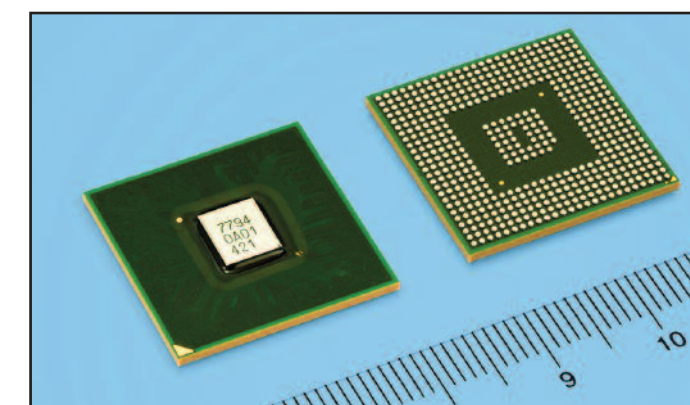
GPS antennas track fleets

Military-grade GPS antennas from Radiall available through TTI can be used in vehicle and fleet tracking, asset tracking, seismic recording instruments, navigation devices, mining equipment, LBS and M2M applications, as well as

handheld devices.

The antennas have a robust design and the range includes passive and active antennas, as well as small, medium and large versions.

Features include low axial ratio performance, right hand circular polari-

sation, high gain performance, and efficiency of 50%. They meet IP68 specifications and are environmentally friendly according to MIL810G, as well as Reach and RoHS compliant. Custom versions are available upon request.

Microcontroller targets dashboard interfaces

Battery balancing

A battery balancer from Victron Energy actively corrects imbalances in banks of batteries in an electric vehicle and can give an alarm if there are large deviations. The balancer can be used for any situation using battery banks comprising two series connected 12V batteries, or several parallel strings of series connected batteries.

Applications include electric wheelchairs, scoot mobiles, emergency vehicles, mobile clinics and service vans.

Batteries can be used in series strings and series-parallel banks, be they 24V, 48V or sometimes higher voltages. When using a series string or series-parallel bank to create differing voltages and Ah ratings from individual 12V batteries, there can be a variance in terminal voltages on each battery. This will cause the batteries to become unbalanced, which can lead to a string or bank failing prematurely.

The latest member of Spansion's Traveo microcontroller family is aimed at rich human machine interfaces (HMIs) in automotive dashboards. For the first time, the company's Hyperbus interface has been integrated with its Arm Cortex R5-based embedded Traveo MCU, enabling seamless connections with Hyperbus memories, including Hyperflash, to provide design simplification and faster performance in automotive systems.

The component is said to deliver 2D and 3D graphics optimised for automotive without increased power and cost.

Claimed to be the first 3D-capable Arm Cortex R5 cluster MCU, the graphics engine provides memory savings, safety features and image capabilities, without the need for external video ram.

There are two variations – the S6J324C enables 2D graphics while the S6J326C supports both 2D and 3D graphics. Both support the Hyperbus interface. This also provides an upgrade path from 2D to 3D. All device variants have a universal footprint with consistent packaging and pin-outs, enabling users to migrate from one device to another without having to alter board layouts.

Communications protocols supported include Can-FD and Ethernet AVB, as well as graphics interfaces such as LVDS Phy and RSDS. It contains multimedia support with a sound system combining 16bit audio DAC and multi-channel mixer.
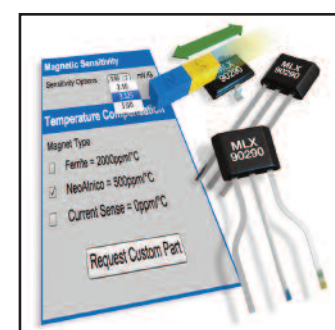
Magnetic sensor handles harsh environments

Melexis has extended its portfolio of factory-programmed Hall effect sensors for automotive, industrial and other harsh environments with the MLX90290, a monolithically integrated magnetic sensor IC, with amplifier, analogue output and internal compensation circuits incorporated.

It converts magnetic flux into an analogue output and guarantees the critical functional parameters – such as sensitivity, offset and their respective thermal drift characteristics – to absolute levels, thus simplifying integration by removing the need for end-of-line calibration. This means engineers can deliver position sensing without extra end-of-line testing and validation; they can simply buy off-the-shelf versions capable of satisfying their sensor requirements.

Standard versions when combined with microcontroller units allow fast and accurate rotary, linear or motor commutation applications to be realised. It can also be applied to sense DC and AC when combined with a ferrite toroid core.

Offered in variations for use with circuits operating at 3.3 and 5V DC bias, the device enables position measurements with most common permanent magnet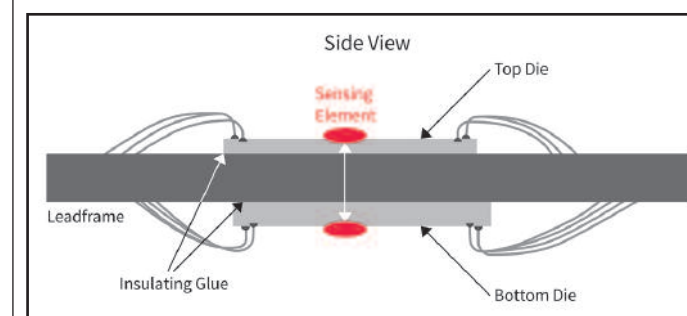s, such as AlNiCo and ferrite. It can compensate for the inherent thermal behaviour of the magnet and comes in off-the-shelf variants for use with 500ppm/°C materials for AlNiCo and rare earth type magnets and 2000ppm/°C materials for low cost ceramic and ferrite magnets.

In current sensing applications, the thermal drift is targeted to 0ppm/°C, so the IC has a thermal behaviour as flat as possible while achieving a high bandwidth.

High volume applications may be deemed suitable for a customised version. Here, filtering, sensitivity and thermal sensitivity drift may be fully optimised to meet specific performance requirements.

Operating temperature is -40 to +150°C. It comes in standard three-pin sip (UA) or sot (TSOT23) packages. The 1.27mm pin-to-pin version is the normal option or alternatively a 2.54mm pin-to-pin spacing, lead-formed version can be specified. The wider pin-to-pin spacing is suitable for welding or automated soldering in sensor modules.

Two into one does go for electric steering sensors

Typically, it rakes two sensor chips for reliable and precise sensing of the steering torque in an electric power steering (EPS) system. Thanks to a dual-sensor package from Infineon Technologies, it might only be one sensor chip in future. The company has introduced two device families of linear Hall sensors and angle sensors using the package.

They support Asil D systems and reduce physical space requirements and system cost; for example in steering applications requiring high availability as used in autonomous driving.

By using a stack mounting technology, the devices combine two independent sensors within standard PG-TDSO packages about 1mm thin. Instead of the common approach of side-by-side sensor placement, the two sensors are stacked with a flip-chip technique. This saves space and cost in safety critical applications, such as EPS, throttle control, pedal position and brushless DC motor control in EPS motors, transmission and clutch actuators.

Both sensors have separate power supply and separate signal outputs. They are electrically independent due to galvanic isolation. This means the two sensors work independently, which increases reliability of the system. The SMD packages have eight or 16 pins. Single sensor versions are also available in the same packages.

Sensor redundancy is of particular interest for EPS systems with increased ISO 26262 requirements and for other safety critical applications that rely on Hall effect torque sensors and giant and anisotropic magneto resistance angle detection.

With the flip-chip mounting technique, both sensing elements are placed in the same lateral position and detect a single uniform magnetic field, which can be compared directly by the associated system microcontroller. In comparison, conventional side-by-side sensor methods detect different magnetic fields. This means the magnetic field must be stronger than the one with the dual-sensor package leading to larger packages, the need for stronger more expensive magnets, and field variations due to the distance between the two sensing elements.

The dimensions of the PG-TDSO-8 package for linear Hall sensors are identical to the footprint of single sensor devices, at 4.0 by 5.0 by 1.2mm. Angle sensors are also available in PG-TDSO-16 packages. Temperature range is -40 to +125°C and they are automotive qualified.

Harness design simplified

At last month's IZB trade fair in Wolfsburg, Germany, Aucotec presented its EB engineering software for harness design in automotive. It supports the increased complexity of wire harnesses arising from the growing number of electronic vehicle components.

The system maps the full complexity of harness design with all its relationship knowledge. This is made possible by a central data model that covers the complete workflow, from the wiring-independent system design via the cable diagram and data output in the KBL-XML standard down to laying and layout in 2D and 3D as well as deploying the actual individual data relevant for manufacturing.

Derived documents such as form board layout or parts lists are generated automatically – and without system breaks, multiple entries or manual supplements. Sources of error are said not to occur

any more, and the data quality increases despite taking less time.

Hundreds of modules, plugs and splices, several kilometers of cable, and more than 1000 individual lines are stored.

It immediately recognises and marks changes in each planning stage. These can be retrieved by everybody involved at anytime. This enables synchronous project editing by several users.

It also supports asynchronous, site-independent operation in different installations, for example. at suppliers' premises, via delta management.

In addition to supplying data relevant for manufacturing, it supports harness design makers via an automated analysis of the manufacturer-specific modularisation and the resulting structuring of the production. This kind of work could formerly cost several human weeks, but this provides the relevant information at the push of a button.
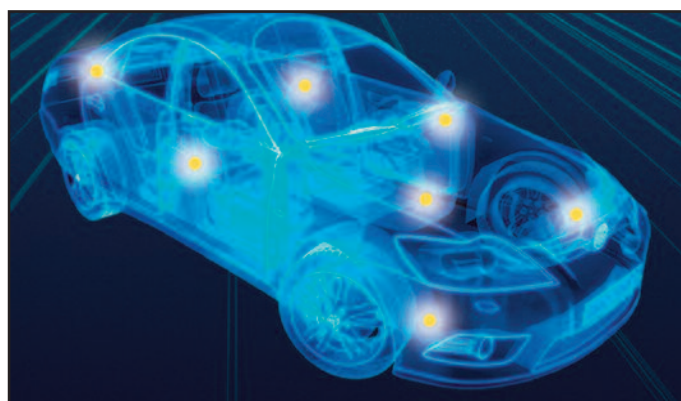
Nine SoCs support loads up to 12A

Nine power system-on-chip devices that comply with AEC-Q100 have been introduced by Altera. The Enpirion devices comprise step-down power SoCs from the EP53xx and efficiency-optimised EN63xx families supporting load currents up to 12A.

Unlike discrete power products, these turnkey parts give designers complete power systems that are fully simulated, characterised and production-qualified, streamlining the design-in process. They are suitable for use with the company's automotive-grade Cyclone FPGAs and SoCs and Max FPGAs and CPLDs.

Adas designers are increasingly turning to FPGAs to run algorithms at higher frame rates, process multiple algorithms simultaneously

and adapt to the latest trends. This makes thermal performance, energy efficiency, integration and small footprint critical.

By integrating the inductors, high-frequency filter capacitors, controller and mosfets, these SoCs typically have a 25 to 50% smaller footprint compared with alternative discrete switching regulators and modules. They have up to 96% peak efficiency.

Applications include head units, display interfaces, instrument clusters, head-up displays, HMI technology, rear-seat entertainment, forward-looking cameras, surround view systems, radar, lidar, rear-view cameras, e-mirrors, telematics, ECUs, battery management, motor control, power conversion and adaptive suspension.
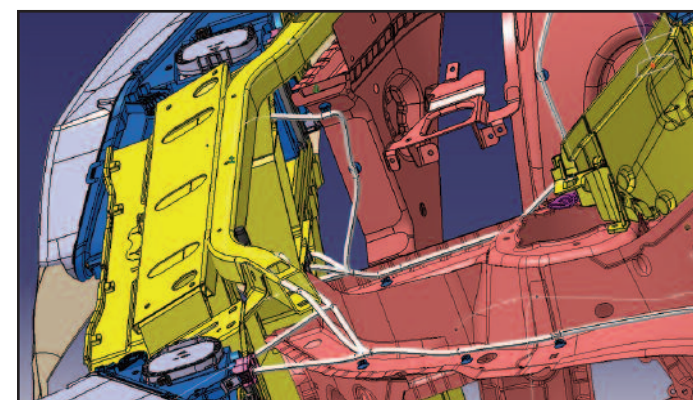
IO cards bring speed to data logger

Rapita Systems has selected Spectrum IO cards to create the RTBx real time, high-speed digital data logger. The M2i.7000 cards were chosen because they have a data acquisition speed of up to 125MHz and a choice of 8/16 and 32bit IO. This makes the data logger suitable for test and measurement applications particularly in the avionics and automotive electronics industries.

It provides a way to collect and time-stamp real-time data from a wide variety of embedded targets, over many weeks if necessary.

"The cards are a standard PCI-X form factor so we can easily integrate them into our product for the data acquisition part, enabling us to concentrate on adding our expertise of

turning that data into useful information for the customer," said Guillem Bernat, CEO of Rapita Systems.

CPU embedded systems communicate their commands and data along digital bus networks most commonly 8, 16 and 32bit wide. Successful execution of code and timing performance are critical factors. This system lets users track down run-time problems across different CPU based systems using a single

generic device. An essential part of the task is collection and storage of time-stamped trace data where collection extends too many days, even weeks.

The verification suite analyses code execution trace data collected from the target. This provides complete timing and coverage analysis, which is essentially a thorough testing of embedded systems source code programme behaviour.

The data logger can be

configured to a whole range of automotive and avionic embedded CPU-based systems with varying data bus configurations. Also the cards' adjustable sampling rates and extended data streaming functionality allow digital trace capture over several weeks or more.

Connection to the data logger is from its rear panel via a ribbon cable to the dedicated output port on the embedded system, which is the source of data (instrumentation points) every few CPU machine code cycles. A connection can also be made to the address bus of the system under test, where the user can write a small instrumentation point routine to provide the data at a specific address.