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EUREKA

THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: Joining & Fastening • Design Software • Sensors, Test & Measurement • BEEAs Review

THE ROAD TO LOW CARBON

New fuel technologies drive automotive design

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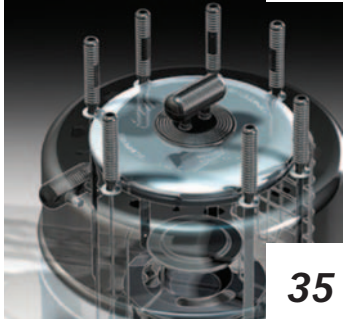
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Confocal measurement system

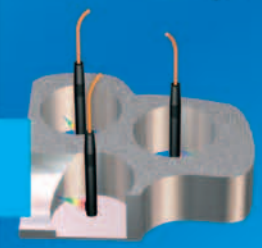
- Measuring ranges from 0.12 to 24mm
- Nanometre resolution
- Tiny, constant measuring spot 7µm
- Measure any target diffuse, specular and liquid

Typical applications:

Measuring of glass and mirrored surfaces

Measurements inside bores and holes

One-sided thickness measurement of transparent materials (e.g. glass)



NEW

optoNCDT 2402
The world's first miniature sensor with just a 4mm outside diameter

Laser profile sensors

- Measuring ranges from 25 to 245mm
- Lightweight and compact sensors
- Very high measuring rate of 256kHz
- 3D view of the target
- Micrometre resolution

Typical applications:

Position and contour measurement, edge detection, web width, groove width / depth, welding seam inspection, welding robot control

NEW

scanCONTROL 2700
Most compact design with integral controller

Laser triangulation sensors

- Measuring ranges from 2 to 1000mm
- Models with integrated controller
- From low-cost entry level models up to highest precision in class
- Analogue and digital interface
- In built synchronisation for thickness measurement

Typical applications:

High precision measurements in automation, positioningand in-process quality control

NEW

optoNCDT 1302 / 1402
Very compact sensors with integrated controller

optoNCDT 2220
Extremely fast measurement with 20kHz measuring rate

optoNCDT 2200LL
Small laser line for metallic, shiny surfaces

Compact infrared temperature sensors

- Temperature range: -50 to 3300°C
- Spot sizes as low as 0.45mm
- CTlaser with built in laser alignment
- CThot withstands ambient temperatures of 250°C without cooling
- Exposure time from 1ms
- Analogue and digital outputs incl. Profibus DP
- Specific models for glass, metals, ceramics

NEW

thermoIMAGER TIM
Thermal imager for inline applications
Temperature ranges: -20°C to 900°C

Eddy-current displacement sensors

- Measuring ranges from 0.4 to 80mm
- More than 300 sensor models
- Nanometer resolution
- Intelligent controller
- Robust sensor - IP67
- Pressure-resistant sensors up to 2000 bar
- Ideal for Machine builders & OEMs

Typical applications:

Harsh industrial environments (resistant to oil, dirt, dust, moisture, interference fields, etc.)

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It's not about 'sheep and goats'

Paul Fanning, Editor (pfanning@findlay.co.uk)

In the inevitable furore that has surrounded the public spending cuts, another – perhaps even more radical – shift in Government thinking has been overlooked.

Education Secretary Michael Gove's announcements on education would appear to suggest that the value of vocational education is genuinely becoming apparent to Government. Proposals include the opening of at least 12 'university technical colleges', which would be academies operating outside local authority control and sponsored by a local business and a local university. Students could opt to attend from the age of 14.

Not surprisingly, this shift in thinking has not been universally welcomed by the educational establishment. Indeed, when the plans for these schools were first announced, Chris Keates, the general secretary of the teaching union NASUWT said: "The technical schools system seems to illustrate a sheep and goat mentality to classifying pupils. This is no way to manage an inclusive state education system."

Unknowingly, Keates' words revealed the real problem at the heart of the educational system – namely, the ingrained idea among many educationalists that practical or technical learning is axiomatically inferior to 'pure' academic learning.

The fact is that this pernicious notion has pushed us into the skills shortage that currently threatens our economy. It is only too easy to look at countries such as Germany where practical learning is valued and respected to see that vocational education can and does co-exist happily with its academic equivalent. However, while this country persists with a 'one size fits all' approach to education that values the academic whilst implicitly denigrating the practical, that will not be the case in the UK.

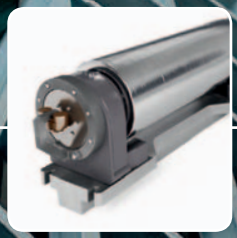
Take steel productivity to new heights

Modern steel allows architects to create the most imaginative designs. SKF engineers, like Dario Rodriguez, work with mills to develop innovative solutions that help produce this steel. Solutions like the SKF ConRo unit; a unit designed to deliver longer service life, reduce operating costs and use up to 65% less grease.

This is a great example of what we call Knowledge Engineering. And yet another way of how we apply our know-how by utilizing our wide range of products and services to help increase efficiency, save energy and reduce environmental impact. Read the full story at **www.skf.com**

The Power of Knowledge Engineering

Continuous caster



SKF ConRo

Dario Rodriguez, SKF

SKF®

PTC introduces Creo software

PTC has unveiled Creo design software, which is being designed as a scalable suite of interoperable, open, and easy to use product design apps.

According to PTC, Creo will help remedy lingering, unaddressed problems that have plagued CAD for decades.

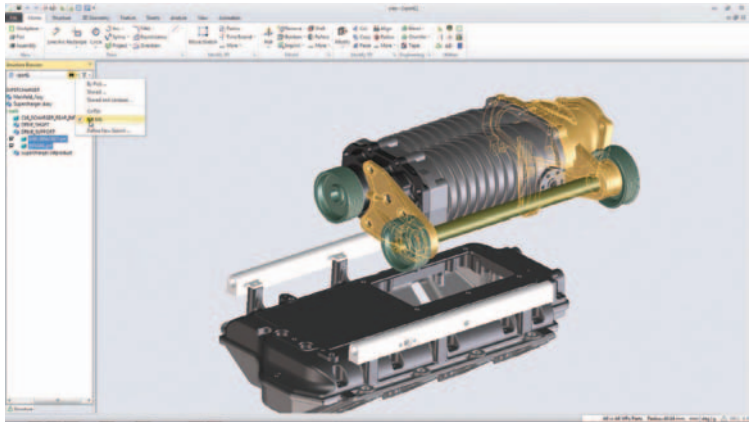
"Creo is being specifically created to solve the big problems remaining in the mechanical CAD market: usability, interoperability, assembly management and technology lock in," said James Heppelmann, president and ceo at PTC. "By providing the right size product design apps for each participant in a company's extended product development team, Creo will enable more people to participate earlier and more fully in the product development process, significantly expanding innovation capacity."

"Historically, companies have made significant investments in CAD applications that bind them into inflexible business processes and design practices dictated by the specific visual authoring or simulation application that they pick. PTC's game-changing vision to release a highly flexible CAD application in a new code base, while sticking to existing file formats under the Creo portfolio, is expected to rejuvenate the mature CAD market and open up a path for non-PTC CAD users to move easily on a flexible visual design platform," added Sanjeev Pal, research manager, IDC.

Planned apps include AnyMode Modeling, which will provide a multi paradigm design platform, enabling users to design in 2D, 3D direct or 3D parametric. Data created in any mode will be fully accessible and reusable in any other mode, allowing each user to work with their own or another user's data in their paradigm of choice.

Other apps include AnyRole Apps, AnyData Adoption and AnyBOM Assembly. More details will be given in next month's issue.

http://www.ptc.com



Government to invest £200m in 'technology innovation centres'

Outlining the Government's new 'strategy for growth', PM David Cameron has spoken about plans to invest £200million in new 'technology innovation centres', similar to Germany's Fraunhofer Institute.

According to patent and trade mark firm, Withers & Rogers LLP, the announcements are a major boost that could significantly increase innovation activity. Adrian Tombling, patent attorney at Withers & Rogers LLP, said: "Bringing German style technology innovation centres to the UK could significantly boost R&D activity and encourage more innovation led businesses to capture the commercial value of their inventions and in so doing, create wealth and jobs.

"This promise of a nationally driven, strategic focus on innovation is reassuring and will go some way to address concerns about the proposed abolition of the regional development agencies, which is expected to take effect in the coming weeks."

Briefs

RESEARCHERS AIM TO USE HUMANS AS WIRELESS NODES

Sensors carried by members of the public could form the backbone of an ultra high bandwidth mobile internet infrastructure - and reduce the density of mobile phone base stations – according to researchers at Queen's University Belfast's Institute of Electronics, Communications and Information Technology (ECIT). Potential applications include remote healthcare monitoring where compact sensors implanted or worn on a patient's body are used to transmit information about their condition wirelessly.

NOVEL TURBINE TO HARVEST TIDAL ENERGY

A new company, Kepler Energy Limited, has been formed to further develop a tidal turbine that has the potential to harness tidal energy more efficiently and cheaply than current designs.

The turbine is the result of research in the Department of Engineering Science at the University of Oxford by Prof Guy Houlsby, Professor of Civil Engineering at Oxford, Dr Malcolm McCulloch, head of the electrical power group, and Prof Martin Oldfield, Emeritus Professor of the thermofluids laboratory.

BRITISH INVENTION SHOW WINNERS

The winners of the 'Obelisk' at this year's British Invention Show Awards were Tsung-Lung/Yang, Jen-Chun/Liao, Wen-Ban/Hsieh and Yun-Hsing from Taiwan for their Surround Headphone System, but British and other overseas inventors also did well with sound commercial products and ideas, and the Iranians presented a superb model of a proposed 'green' science city.

Solid-state oil or water level sensor

The updated efector gwr microwave sensor from sensor manufacturer ifm electronic is characterised by flexible and easy installation,. The new units are distinguished by better performance and extended application possibilities.

Advantages of the microwave radar system lie in its ability to ignore residues of sticky material that might build up on the probe and give a false level. This feature also ignores foam and sees the true level. The solid-state principle avoids mechanical issues with floats that stick.

The three new versions of the tried-and-tested level sensor can now be used in aqueous media, coolants and cleaning solutions or oils. This makes them suitable for continuous level monitoring of almost all liquids. ifm electronic offers the efector gwr with two (order no. LR700s) or four (order no. LR8000) switching outputs or with switching and analogue output (order no. LR3000).
www.ifm.com/uk

Solution to last month's Coffee Time Challenge

The solution to our October Coffee Time Challenge is to use large inflatable Raft style 'Pipestoppers' made by Huntingdon Fusion Techniques. These are normally used for low pressure hydrostatic tests, on-site thermoforming of bends in ducting and conduit materials, and weld purging to isolate volumes in tanks, so that minimum volumes are left for inert gas purging. The inflatable outer ring of this particular style has a bonded neoprene rubber layer to provide a seal and provide resistance to petrochemical fuels. A variety of sizes and styles is available from 50mm up to 2000mm diameter. Custom designed shapes and sizes and accessories can be made to order. The Pipestoppers can be inflated either by foot or electric tyre pump. The French highway authority is so pleased with the first batch of products it has placed a repeat order.
www.huntingdonfusion.com

Sensor sets high web detection standards

Sick's new compact Ax20 array sensor delivers high-performance web positioning and edge detection solutions for the printing, packaging and textile industries. The scanning opto-electronic system offers repeatable automated object detection with a resolution down to 50 microns, allowing precision control of web position at high operating speeds.

The compact Ax20 requires no reflector, so is easy to locate and mount, and is simple to adjust for optimum results. The sensor is immune to high levels of ambient light and reflective or transparent materials, enabling it to be used with a range of materials.

As well as high-speed web detection, the Ax20 line sensor can be used in a variety of applications, including edge detection and thickness measurement of sheet fed material such as paper and card, even in stacks. Other applications include counting small parts, determining positions and widths, such as screw holes, tracking glue beads and detecting edges of objects such as electronic PCBs.
www.sick.co.uk

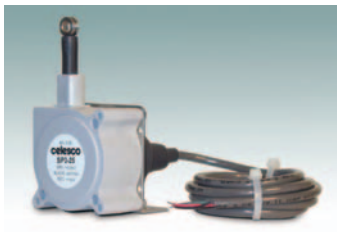
Transmitters achieve easy adaption

Bürkert has expanded its clean line, stainless steel Element range of products for total loop process control – hygienic or aggressive - with the launch of Element Neutrino analytical transmitters. These units, the 8202 (for pH or redox potential) and 8222 (for conductivity) combine high-performance with economy. Versatile in use, they are designed for operation with different sensor types, offering easy adaption across the widest range of applications where measurement of pH, ORP or conductivity is required.

The Neutrino analytical transmitters are the latest building block in Burkert's modular Element system, which sets a higher benchmark in process measurement and control systems. Element is a complete systems approach, linking clean line valves, sensors, positioners and valve actuators in an intelligent architecture to solve total control loop processes. With unlimited modularity,

The new Neutrino transmitters offer OEMs maximum economy, providing a lower cost alternative to Element transmitters which integrate displays and keypads. They feature a patented variable electrical connection for pH electrodes, making it possible to use most pH electrodes with a 12 mm diameter and an S7 connection.
www.burkert.co.uk

Pot sensor features user-selectable output



Variohm EuroSensor's new SP3 String Pot sensor from Celesco Inc. features a rugged cable extension design with a plastic-hybrid precision potentiometer and winding drum in an economical and flexible package that can be user configured for a choice of 4-20 mA or 0-10 VDC output by simply connecting the appropriate signal wires on installation.

With precision absolute linear position measurement in a choice of four ranges covering 120 mm, 315 mm, 635 mm and 1270 mm, the extremely compact unit can be mounted within an envelope of just 25 mm wide x 50 mm deep x 90 mm high and its durable water resistant polycarbonate housing has four point fixing and an optional (or is it included?) bracket that facilitates universal mounting.

The SP3 has an acceleration rating of up to 15g in retraction and a rated life of over 2.5 million cycles for the 120 mm travel unit (250K cycles for the 1270 mm travel version). Overall accuracy is between 0.25% to 1% FS depending upon stroke length, repeatability better than 0.05% FS, and the measuring resolution is essentially infinite.

www.variohm.com

Push-fit joiner quicker and easier

FDB Panel Fittings has introduced a novel captive SNAP-Joiner which fits the standard 19" rack 9.5mm x 9.5mm cutout and is quicker and easier to use than the traditional screw with cup washer and cage nut. SNAP-Joiner is simply punched into the front panel where it is held by spring clips, this assembly is then mated to the rear panel and the SNAP-Joiner core push fitted to activate spring wedges which accommodate a clamping range of up to 5.2mm in a vibration proof connection.

www.fdb.co.uk

Compact, low cost digital indicator now with optional remote control

Process manufacturers, panel builders and systems integrators are set to benefit from a new low-cost, loop-powered digital panel meter, which offers a very shallow installation depth and is ideal for in line installation with current output sensors or where there is a need to view multiple process parameters quickly.

The SWE-73-L digital panel meter from Impress Sensors & Systems Ltd offers an installation depth of just 78mm and is available with an optional remote control unit for configuration and programming of the display.

The indicator has a single 4-20mA current input, which simultaneously powers the device. The indicator can therefore be installed in line with a current sensor and will display the sensor output. Measurement input is equipped with safety circuits, protecting the unit's internal electronics from overload.

www.impress-sensors.co.uk

Green technologies hit

The drive for alternative automotive fuel sources means that motor vehicle technology is going through an exceptional rate of technical development and change. Hybrid and battery electric vehicles are becoming more and more commonplace and advances are taking place not only with regard to electric drives, but also alternative fuels and components such as turbochargers, with huge consequential improvements in power and performance per unit weight as well as enhanced fuel economy.

However, while some still see fuel cells as a way forward, and battery electric delivery vehicles are definitely the solution of choice for short runs with lots of stops and starts, it would seem that the internal combustion engine is likely to remain the power plant of choice for most vehicles, albeit in a greatly improved form.

Jason King, the chief engineer of Ricardo, described at the recent Cenex LCV 2010 event at Millbrook how he expected the HyBoost project to reduce the carbon emissions of a two litre Ford Focus engine from 169g/km to 99.7g/km, and hopefully to the 89g/km achieved by the hybrid Toyota Prius, but at much lower cost.

A crucial part of the development is an electrically-driven supercharger which we assume to be the VTES (Variable Torque Enhancement System) supercharger made by collaborating company, Controlled Power Technologies (CPT). The turbine is driven by a switched reluctance motor and can accelerate from idle to its maximum speed of 70,000 rpm in less than one third of a second. CPT recommends using their electric superchargers in series with a conventional supercharger. The VTES technology can also be used to reduce soot and particulate emissions from diesel engines.

Supercharged design

An alternative suitable supercharger for such projects could be the 'TurboClaw' being developed by Dynamic Boosting Systems, a spinout from Imperial College, London. Invented by DBS founder and managing director Dr Shahram Etemad, it uses a flat impeller with a very high forward sweep. Dr Etemad said that the design delivers the same amount of air at 50,000 rpm as a conventional centrifugal turbo impeller delivers at 100,000 rpm. Using a software model developed by AVL Powertrain, he said it should allow a one litre engine to have the performance of a conventional 1.4 litre engine.

According to Rik Alewijnse, design team leader with AVL Powertrain, the design also has other applications because: "It sits in the design space between a screw compressor and a centrifugal turbo impeller in terms of mass flow and speed", adding that its shape is easily injection mouldable, because it is flat, instead of being three dimensionally curved. Efficiency comes, he said, because, "There is no pressure rise in the impeller, it all happens in the diffuser."

Another aspect of the Hyboost project involves having a starter/generator. One of the participants is Valeo, which makes the StARS - (Starter Alternator Reversible System). An improved starter/generator system that allows drivers to change their minds about stopping in traffic is the 'SpeedStart' developed by CPT. With a conventional starter motor adapted for stop/start, the engine cannot be prevented from shutting down when rpm drops below a certain speed, prior to restart. With the new system, the driver can leave the vehicle in gear in gear and no matter how low the engine rpm, an instant restart is achieved by simply coming off the brake pedal, in less time than it takes the driver to move their foot to the accelerator. To achieve this, the company uses a liquid-cooled, switched reluctance machine which generates peak currents of 205A, a maximum continuous output of 2.7kW and has a starting torque of 72Nm. Response time to establish full current in its windings is less than 10ms. It is claimed that the stop/start capability provides a 3% to 5% reduction in CO2 emissions. The increased efficiency of the switched reluctance machine gives a further 1%. If additionally used to provide regenerative charging during vehicle deceleration, this provides a further 3% to 5%.

Stop-start system

Also on display at the event was a Ford Transit van equipped with an Ashwoods Automotive retrofit system as well as one of the company's hybrid add-on transmissions. The company claims that the stop-start system can be fitted by a competent mechanic in less than an hour and reduces fuel consumption and emissions by 5% to 10%. It shuts down the engine when the vehicle is at rest, and automatically restarts the engine when the drive pushes the clutch pedal.

The add-on hybrid transmission takes power from and delivers power to the rear differential via a pulley and toothed belt which drives and is driven by a permanent magnet brushless motor generator. When the brakes are applied, energy is taken from the transmission to drive the motor generator to produce power which is stored in a lithium ion battery within an intelligent power pack module beneath the sliding door. During acceleration, power is drawn from the battery and sent to the motor generator to assist acceleration. Detection of braking, accelerator position and speed is achieved by plugging into the vehicle CANbus. A simple dashboard display shows what is happening and suggests changing gears up or down to improve fuel economy. Fuel and carbon savings are said to be 15% to 25%, depending on the vehicle drive cycle. The vehicle drives like a normal transit and should the system fail, it reverts to being a conventional vehicle. One of its big attractions is that it requires no hole drilling or other vehicle modification, attaching to holes that are already there. This ensures that there is no effect on vehicle warranty. The retro fit stop start similarly has no effect on vehicle warranty. Ford has endorsed the system and Ashwoods managing director Mark Roberts told us that the system is to

fast forward

Tom Shelley reports on the latest advances in low and zero emission vehicles.

One of the key technologies to have emerged at the recent Low Carbon Vehicle Event was an electrically-driven supercharger being employed in Ricardo's HyBoost project, as well as a number of other electric and low-carbon vehicles.

be offered through a number of Ford dealerships. It takes about four hours to install. Since its launch in 2009, more than 130 hybrid equipped vans have been delivered. The Department of Transport recently selected Ashwoods as the sole supplier of more than 130 hybrid vans for its Low Carbon Vehicle Procurement Programme (LCVPP), managed by Cenex. Roberts said that this had allowed them to reduce the cost of the system by 10%. I expect costs to reduce by 25% when sales hit 500 vehicles – at which point it will make sense for the man in the street to buy one."

Most of the other vehicles at the LCV event were demonstrating either battery electric propulsion or use of alternative fuels. Roberts said his business originally started out doing conversions to use liquefied petroleum gas, but he did not see much future in this. Much more future is seen in using methane, either in the form of compressed natural gas or biogas, or biologically derived methanol and ethanol. Lotus has a demonstrator sports car that can run on either gasoline, methanol or ethanol, but use of ethanol may be criticised on the grounds that it presently comes from agricultural products, reducing land available for growing food and encouraging the cutting down of forests. Methanol is mostly made from natural gas, so it makes sense to use natural gas directly.

Natural gas is mostly methane, but so is biogas, which offers the advantage that it can be made by fermenting waste organic matter out of the presence of air, and is a natural product produced by most rubbish dumps. The difference is that biogas is only about 60% methane, whereas natural gas as delivered is usually about 95%, although engines can be made to run on either. There are more than 125,000 biogas digesters in Nepal, more than two million in India and around five million in China. Most are used to produce gas for cooking as an alternative to wood or fossil fuels. However, they show the real practicability of moving to a methane-based mechanical economy, rather than the idea of a hydrogen-based economy, with hydrogen consumed in fuel cells. The big problem with hydrogen is that when used for fuel cells, it has to be extremely pure, and is mostly made by the steam reforming of natural gas. The fuel cells also remain prohibitively expensive at the present time and are likely to remain so for the immediately foreseeable future.

India is moving towards increasing the number of vehicles running on compressed biogas. The Indian Institute of Technology Delhi has a patent on a new process for increasing the methane content to around the 95% methane normally found in natural gas. A number of companies in the UK are currently running delivery vans on biogas-derived methane using systems and fuel supplied by Gasrec, which supplies liquid 'biomethane', produced by processing biogas so as to improve its quality as a fuel. Equipment to produce and process biogas is sold by, among others, Biogas Products, based in Warley in the West Midlands. According to the company's Tony Smith, they supply Danish made 'BioGasclean' scrubbers to remove hydrogen sulphide, which is essential if the gas is going to be used in engines, and Italian made membrane gas holders. At the LCV event, Sean Hill of GENeco brought a VW Beetle converted to run on biogas derived methane by the Greenfuel company in Bath. The car is started using petrol and when the engine is up to temperature, the system automatically switches to methane.

The remaining sector of low or zero carbon vehicles are those running on rechargeable batteries. Battery electric fork lift trucks and milk floats have been in use for decades. China has announced that it intends to spend $15 billion to develop new hybrid and electric vehicles. A quick search on alibaba.com shows 3,492 different electric car offerings from Chinese manufacturers and recent visitors report large numbers of electric vehicles on the streets of Chinese cities, including around 120 million electric bikes. The main limitation to their greater use in the West is the batteries. Lead acid batteries have an energy density of 30 to 40Wh/kg whereas lithium ion batteries have an energy density of 100 to 250 Wh/kg but they cost more. Nonetheless, both Allied Electric in Glasgow uses lithium-ion for their Peugeot derived vans and people carriers as does Smith Electric Vehicles for their Ford derived vans, minibuses and small trucks.

"I expect costs to reduce by as much as 25% when sales hit 500 vehicles – at which point it will make sense for the man in the street to buy one."
Mark Roberts
Ashwoods Automotive

Both Allied Electric and Smith Electric Vehicles claim 100 mile ranges for their products and Johnny Swinhoe, mechanical design engineer with Smith Electric Vehicles insisted that they were economically viable, despite the cost of the batteries. Swinhoe says that the electric drive train for the company's 'Edison' panel van and minibus uses a 90kW induction motor and battery packs with capacities from 36kWh to 50kWh. When we asked whether that meant that endurance might be rather short, he explained that the 90kW is the peak draw – most of the time the power consumption is a lot less, and energy is also routinely recovered during regenerative braking. Smith Electric Vehicles US has announced an order for 176 120kW 7.5-12 tonne 'Newton' electric trucks from snack food company Frito-Lay.

While most of the presently commercially viable electric vehicle projects in Europe seem to involve delivery vans, Siemens, working with Ruf Automobile has developed a 'Greenster' electric sports car based on a Porsche 911. It has a 270kW motor producing 950Nm torque and can reach 142mph. It has a range of 125miles and can be charged in less than an hour from a 400V outlet. 0 to 100km/h takes 5s. The 205 mph C-X75 hybrid supercar that Bladon Jets in Ellesmere has been developing with Jaguar. At its heart are two mid-mounted micro gas turbines that can either charge the car's batteries or provide supplementary power to the electric motors.

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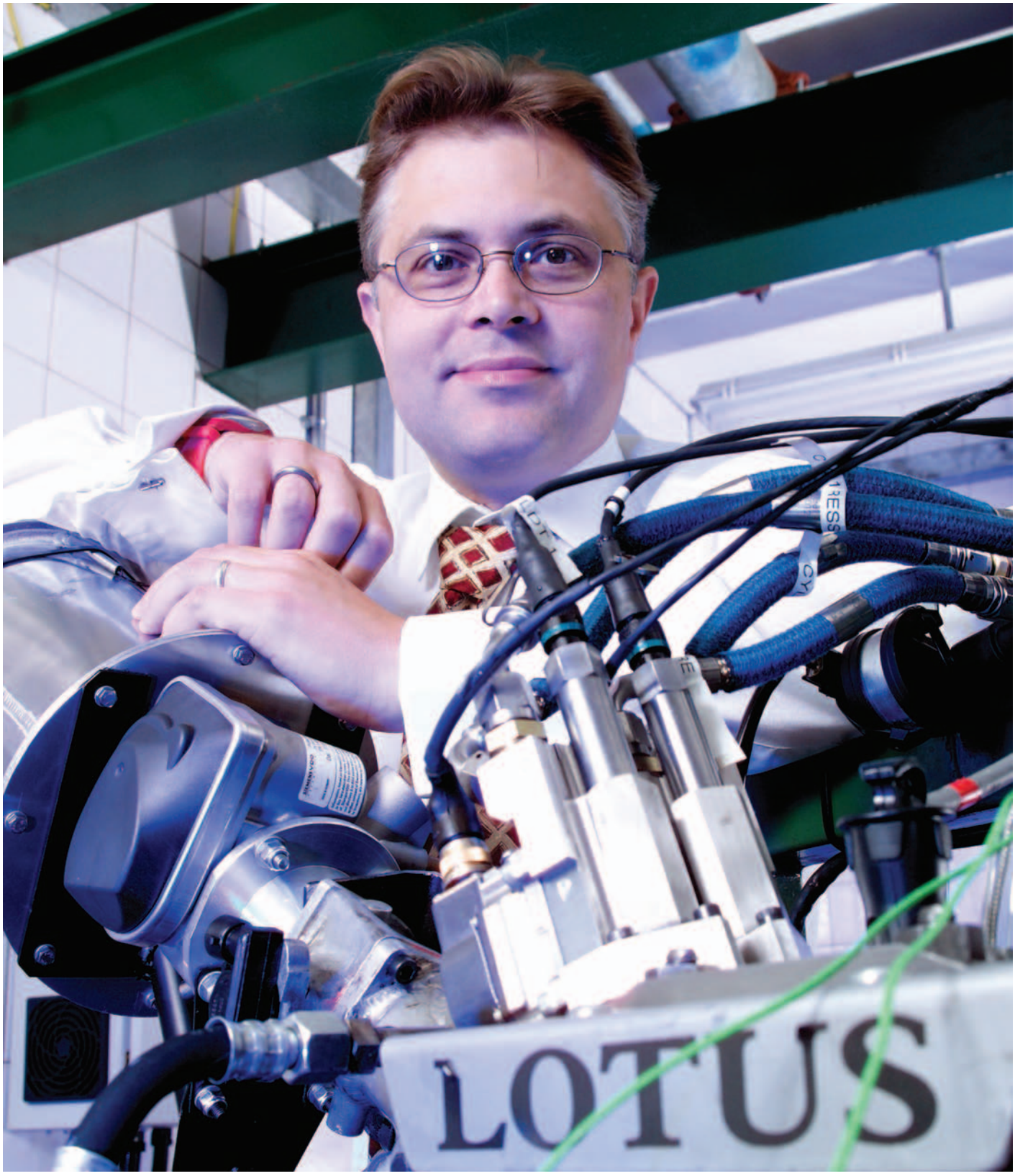
LOTUS

The future of fuel

How will cars be designed in the future? Paul Fanning speaks to Jamie Turner of Lotus Engineering.

The question of future vehicle technologies is at the front of many minds. As oil prices rise and demand for 'greener' cars increases, the best minds of the automotive industry have been tasked with changing the face of transport.

One such mind belongs to Jamie Turner, chief engineer – powertrain research for Lotus Engineering. The array of competing technologies produced lead Turner to conclude that "In reality, the range of future transport technologies is going to be very mixed." Quite how mixed, however, is another question.

Lotus Engineering's efforts in this direction include the Lotus Range Extender engine, which features an innovative architecture comprising an aluminum monoblock construction, integrating the cylinder block, cylinder head and exhaust manifold in one casting. This results in reduced engine mass (56 kg/123 lbs), assembly costs, package size and improved emissions and engine durability. In addition, the design of Lotus' Omnivore variable compression ratio, flex-fuel direct injection two-stroke engine, which achieves 10% improvement in fuel consumption compared to stratified direct injection engines.

Two-stroke engine concepts are close to Turner's heart. He says: "The four-stroke engine is an automotive peculiarity. An engineer 100 years ago tasked to come up with the ideal automotive engine would not choose the four-stroke engine. While four-stroke engines are now very reliable and pretty clean, the elephant in the room is throttling loss at part-load, which is where vehicles run most of the time."

By contrast, he claims, the two-stroke engine is much better suited to the automotive sector. He says: "The two-stroke engine doesn't scavenge its own energy, so there's no throttling loss. This was a clean sheet of paper design and all along we liked the two stroke because it's a much better match with how we use engines in the real world…two-strokes are the most efficient engines around!"

Another innovation seen in the Omnivore is the homogenous charge compression ignition (HCCI), which allows the engine to operate without the need for the spark plug to ignite the fuel and air mixture in the cylinder – down to extremely light loads. Traditionally, this has been challenging but this combustion process results in ultra low emissions and has been achieved over a wide range of engine operating conditions. "It's theoretically a panacea," says Turner.

These innovations do not mean, however, that Turner is dismissive of the idea of electric vehicles. He says: "Our view of the future electrification of vehicles is that the plug-in hybrids make a lot of sense." However, he does point out the core drawback of pure electric vehicles, saying: "The problem is that electrical storage is massively, massively expensive. In addition, the materials (such as cobalt) are rare and in unfriendly countries…Batteries currently cost $1000 per kWh and the most ambitious view is that we might get down to $300 per kWh. So, given that 1kWh of usable discharge gives you three or four miles on the drive cycle, $100 per mile of range is the cheapest it will ever be.

"The other thing is that people don't know how long these batteries are going to last. The current assessment of the five-year value of an electric car is £3,000. At the moment, they can cost £25,000! I can't see how they're going to sell the thing beyond the early adopters." As for the possibility of hydrogen, Turner says wryly: "Hydrogen's a great technology for the future – and always will be."

So what is the future for automotive technology? His view is firmly that the internal combustion engine is not going away. He says: "I've given up counting how many times I've been told that there's 'no silver bullet'. In my opinion, that's completely wrong. People have forgotten what happened at the dawn of the automotive industry. The internal combustion engine has killed the electric battery before – don't forget that. It is the silver bullet. The fuel's cheap and the engine's cheap. Economics and thermodynamics are on the side of the IC engine."

"The IC engine has killed the electric battery before – don't forget that."

The question of how fuel can be kept cheap as oil reserves decline is answered, Turner believes, by another fuel: methanol. He says: "An IC engine will burn a wide range of substances – ethanol, methanol, ammonia – but it's a question of what's miscible with gasoline or diesel. I propose methanol as the 'end game', because it's already a proven internal combustion engine fuel, can be synthesised from a huge range of feedstocks and by careful management of the production and use cycle could be made to be 100% carbon neutral. What's more, there is the possibility to manufacture all the fuel energy we need…After all, nuclear subs make methanol out of waste CO2 and hydrogen and just pump it out. It's been being done for 50 or 60 years."

While alcohol fuels contain less energy than gasoline returning a shorter range for a given volume of fuel. However, Turner is dismissive of these arguments saying, "No-one really cares what volume of fuel is in their car? It is the energy they have bought. With modern, 'smart', fuel pumps it would be an easy matter to calibrate them to dispense fuel by energy content rather than volume."

If Turner is right, then it would seem that the internal combustion engine will be with us for many more years to come.

The sticking point

***Eureka*'s Joining & Fastening Round Table event concluded that much greater knowledge and consideration of joining techniques is needed.**

L to R: Dr Ewen Kellar; Paul Fanning; Phil Kempson and Ged McGurk

PARTICIPANTS

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Phil Kempson
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Ged McGurk
Technical director
Henkel

L to R: Colin Chapman; Nick Bennett and Peter Frank

The event began with discussion of the results of Eureka's survey into joining and fastening. This revealed that, while respondents rated their knowledge of mechanical fastening and welding as fairly good, more than half described their knowledge of adhesive technology as either 'poor' or in need of 'brushing up'.

These results did not surprise the panel. It was felt generally that lack of knowledge of adhesives has tended to negatively affect people's views of the technology. Nick Bennett suggested that poor knowledge had led to companies having bad experiences in the past, which in turn had shifted their thinking away from many adhesive solutions, saying: "Modern project management techniques look at the end gain and detail what went wrong. The next guy comes along and looks at it and says 'we had a problem with that adhesive' and potentially there's a negative knock on effect in terms of the perception of the technology as a whole."

Ewen Kellar took up this point, saying: "Often the adhesive will be blamed and it's nothing to do with the adhesive. It could be to do with the surface preparation, it could be to do with the way it was applied or, critically, it could be down to the joint design because adhesives are stress sensitive. More often than not, it's to do with other things. The whole concept of how the adhesive should be applied and what's required can be massively misunderstood, but rather than examining that, people invariably just say 'the glue doesn't work'."

One of the key problems, it was felt, was that adhesives – being a chemical rather than mechanical solution – did not represent an intuitive process as far as most engineers are concerned. Peter Frank said: "We're more and more used as a society to being able to get something out of a box and using it straightaway. After all, who reads instructions? We're used to everything we buy being intuitive and the

problem with the adhesives we're talking about is that they're not intuitive in that sense. You have to read the instructions…As a customer, I'd say that, if I were buying a glue, I'd phone up and ask for help, but if I were buying a mechanical fastener, I'd think it was obvious and wouldn't bother. And then I'd probably get it wrong and realise it wasn't obvious, but I think that's the way people think."

According to Ged McGurk, this is a common problem. He said: "With an adhesive, they all look the same coming out of a tube and squeezed onto a join, but they all have vastly different qualities. People think they know what they're doing, but in fact they don't have enough knowledge."

The sheer speed with which adhesive technology is advancing is another problem, according to Nick Bennett. "There are so many adhesives out there," he said. "The technology's advancing all of the time. There is absolutely no way I could be up to date with all of them. So I will tend to ask an expert when I don't have enough knowledge. But at least I know what I don't know."

Acknowledging this issue, Colin Chapman said that the only way to address it was on a case-by-case basis rather than trying to educate everyone about the benefits of every possible adhesive. "We'll establish the application area and try to give them a push in the right direction in that specific case," he said. "We accept that education is the biggest issue – at university level and at company level. The snag is that someone will use an adhesive and say they know everything about adhesives and then you'll find out that they're using the wrong adhesive."

A fundamental lack of education about the technology was felt to be another major problem. Said Ged McGurk: "I wouldn't be at all surprised if those who considered themselves good on adhesives would be at a much lower level relative to those who considered themselves good on mechanical fastening. A number of the problems with adhesives stem directly from a lack of awareness and knowledge of the subject. If you go right back to college courses, the number of those who will have spent more than half an hour in their three-year undergraduate programme studying adhesives will be very low. And yet they will all have a good understanding of mechanical fasteners and of welding."

On this point, however, Nick Bennett disagreed. Despite their self-assessment, he did not agree that the knowledge of mechanical fastening systems was everything it could be, saying: "I don't necessarily think that they do have a good knowledge of mechanical fastening. We have lots of experiences where someone has specified what they think is a simple nut or bolt and they get the torque wrong and the bolt fails after a while. There are so many issues we've seen when people say 'well, it's just a nut and bolt, isn't it?' and you have to say to them 'No, it's not'."

Phil Kempson agreed, saying: "We do have a lot of cases where engineers say they do understand the technology and say they do know how to design stuff in. Particularly with our captive hardware, we'll get people coming to us and saying there's a quality issue or the screws are falling out, but in fact 99 times out of 100 it's an application issue. It's that the panel's not prepared correctly or the whole diameter's wrong or the material's too hard or they're trying to install it too close to the edge of the panel. It's stuff like that rather than the product itself. When it comes to specifying our more specialised

products like quarter-turn fasteners, we've got to make sure the customer's got the right length of stud or the materials are right. It's exactly the same as we've all experienced with customers: they say they know how to do it, but when it comes down to it, there are lots of issues."

It was agreed that, in order to be successful, the sale of joining and fastening products needed to be a consultative sales process. However, it was also acknowledged that there were difficulties with this, Phil Kempson saying: "I think the difference is that we'd like to think it's a consultative sell and we think we'll help them through it, but they just think 'All I need is some glue or nuts and bolts'."

However, the most fundamental problem, many believed, was a failure to educate engineers about joining and fastening methods at schools or colleges. On this subject, Ewen Kellar was emphatic, saying: "I think there's a critical thing about pre-industry knowledge at colleges and universities on fastening and joining. I'm continually amazed by how little time is spent on fastening and joining. They're doing three years and it's probably only two or three lectures in all that time – of which adhesives will only make up a small part. They're spending all this time learning about materials and their properties and they're doing nothing about how to join it together! It's atrocious."

This, it was believed, has led to a situation where joining and fastening methods were not being considered properly at the design stage. Said Nick Bennett: "We sell a lot of hinges. Customers will design a brand new product and then think 'we'll fit a hinge later'. And then they get to the stage where they need it, ask for a hinge that does a certain job and we have to tell them it's physically impossible and won't work."

Colin Chapman agreed, saying: "We have the exact same problem with adhesives. What adhesive you're going to use on a joint design is usually the last consideration."

This failure to assess joining methods is, believes Nick Bennett, has deep roots. He said: "I wonder whether most designers get into the focus of thinking they know what they need to do to make their product, but the bits on the edges like adhesives, fasteners or nuts and bolts get left until later because 'that's the easy bit'. So they focus on what they do, but they get to the point where they need to talk to us and suddenly it doesn't work."

Ged McGurk, on the other hand, suggested that joining methods were considered at design stage, but in insufficient detail. "They'll usually consider how they want to bond or join something, but they generally won't allow that to influence their choice of materials. So, by the time they come to us, we have to tell them they've chosen the worst possible material they could have picked. Among all of the performance criteria they have used to select their materials, bonding capability has never been on the list. That's the challenge to the industry to make sure we can give them a solution, but the whole design concept would have been so much more successful if they'd done that evaluation up front."

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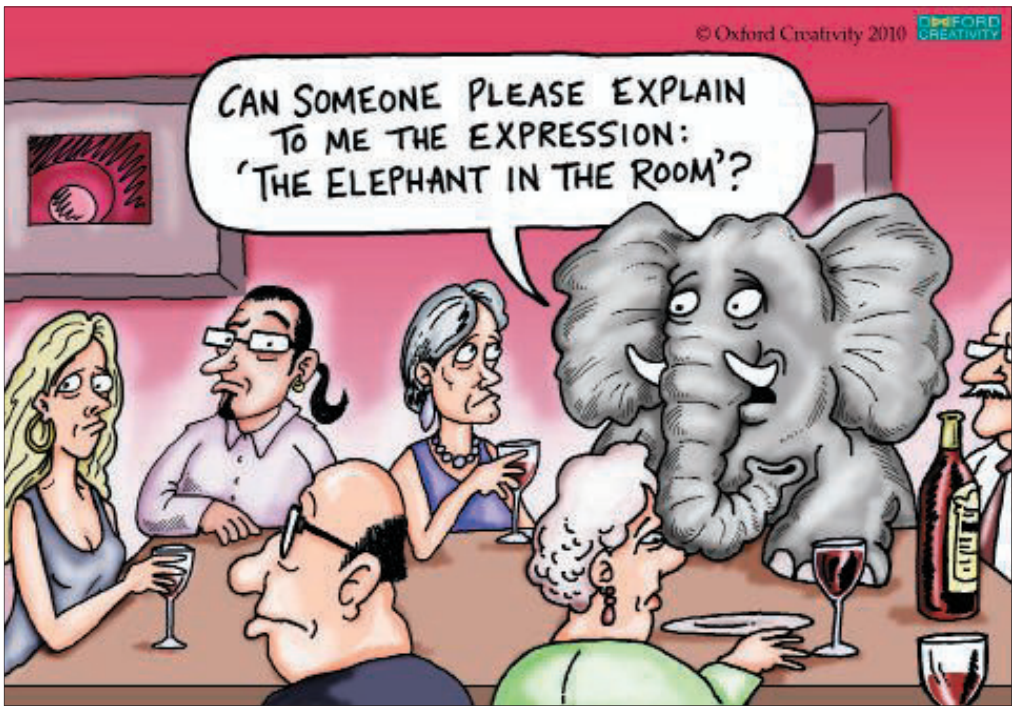

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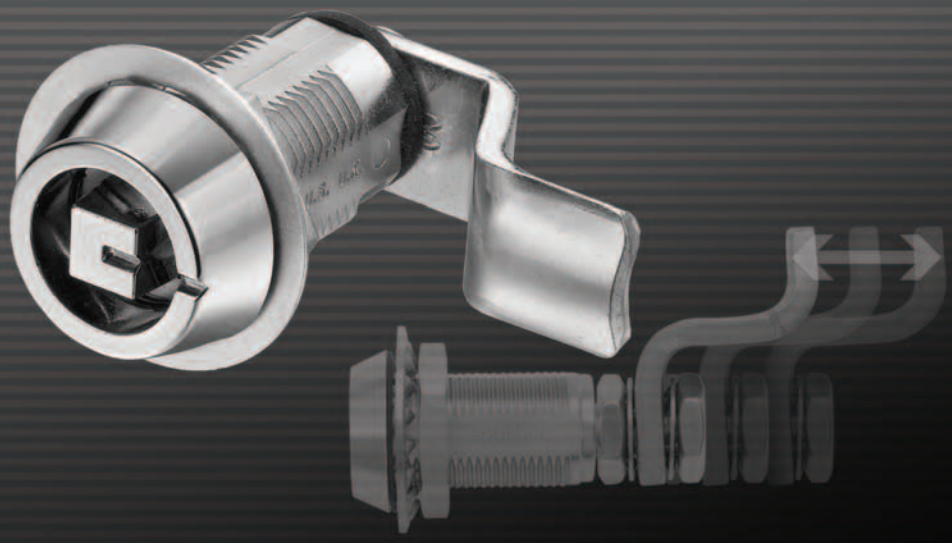

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Cream of the crop

This year's Awards showed the depth and breadth of engineering excellence in the UK. Graham Pitcher reports.

The winners of the 2010 British Engineering Excellence Awards were announced at a gala luncheon at London's Globe Theatre on 14 October.

Congratulations to all the winners and to Grand Prix winner Andrew Burrows in particular. And thanks to all the companies that entered. The BEEAs will be back again in 2011, so watch out for the call for entries next year.

1 Grand Prix 2010
Sponsor: Electronics Leadership Council
Winner: Andrew Burrows

The winner of the British Engineering Excellence Grand Prix was Selected from winning entries in the other Award categories, the winner of the Grand Prix impressed the Judges with an elegant solution to an urgent worldwide problem. They declared the solution had been arrived at 'by thorough process and methodology'.

A quarter of domestic water that has been collected, filtered, chlorinated and raised in pressure using large amounts of energy is lost during distribution through leaks: 32billion m3 of treated water a year, according to the World Bank.

With no available solution, Andrew Burrows designed an intelligent valve, controlled by a central server which learns the behaviour of the network and constantly adjusts the pressure to the optimum. This smart water system reduces leakage by reducing pressure to the optimum to satisfy demand.

On average each system installed reduces water leakage by more than 20%. Each of 50 systems installed in Malaysia during July 2010 are saving 250tonnes of water per day.

2 Judges' Special Award
Sponsor: Bloodhound SSC

Winner: Dexela

A number of finalists for the British Engineering Excellence Awards were considered by the Judges, but Dexela was selected as the winner, having made a strong showing in a number of categories.

The company, formed in 2005, has built a portfolio of IP and is now a leading company in computational techniques for image reconstruction.

Although four suppliers dominate the market, Dexela has a first to market approach. Its small fast moving development team and strong development partnerships, have allowed it to prototype and supply a new generation of large area cmos xray detectors ahead of its competitors.

A responsive approach to market requirements and to the requirements of individual customers has meant that Dexela has developed new detector models, all employing a common modular technology platform, in a matter of months.

The Judges said that Dexela has exploited cutting edge technology to create a product that works and has proved its worth across the world.

3 Consultancy of the Year
Sponsor: Prototype Projects

Winner: Drive System Design

Many factors help to identify a good consultancy, but standing out this year was Drive System Design, which impressed the Judges with its innovative work for automotive manufacturers.

Formed in 2007, the company specialises in delivering cost effective projects against extreme time constraints and providing access to innovative technologies and solutions. By 2010, Drive System Design had secured contracts with Aston Martin Lagonda, Audi and Hyundai, amongst others. Now, it is looking to expand its work to address the military, renewable energy, rail and aerospace markets.

Drive System Design has also become an authority in hybrid and electrical vehicle transmissions.

4 Small Company of the Year
Sponsor: Technology Strategy Board

Winner: OC Robotics

Assessing entries from companies with no more than 20 employees, the Judges looked for those which demonstrated a sound business strategy and addressed a particular market need.

Formed in 1997, Bristol based OC Robotics is extending the reach of robotics with a snake arm robot, for which it holds critical patents. The device can reach into confined spaces by following a defined path. The technology is scalable and can be adapted to fit any environment, space or task. Potential markets include nuclear inspection, security, aerospace and medical.

The 16 strong company's first product was a system to inspect and repair pipes beneath a nuclear reactor; business won against strong competition from multinationals.

One of the challenges in its latest product was to simulate the proposed design. Alongside helping to refine the specification, this also allowed the customer to use the device virtually and to provide feedback.

Highly commended: Congratulations to Dexela, whose entry was highly commended.

5 Green Product of the Year
Sponsor: National Instruments

Winner: Dunphy Combustion

Judged on the application of appropriate technology to the design of the entered product, the Judges also looked for evidence of the product's 'green' credentials.

Dunphy's solution addressed the generation of NOx, which can cause smog and react with sunlight to form ozone. Reducing the production of thermal NOx – caused by a high flame temperature – has been one of the main targets for Dunphy Combustion's T-series burners.

The ultra low NOx burners have enabled the company to increase its market penetration in countries with strict low emission standards.

Apart from reducing NOx emissions, the burners also reduce electrical energy consumption of up to 65%, eliminate the need for flue gas recirculation and duct work, and reduce noise.

6 Start up of the Year
Sponsor: Cambridge Consultants

Winner: JAOtech

The 'better mousetrap' is the milieu of the entrepreneur; the person who has spotted a gap and is determined to fill it.

The 'better mousetrap' here has been developed by JAOtech, which has established itself as the market leader in the design and manufacture of a range of embedded smart terminals intended for use at patient's bedsides.

Formed in August 2006, JAOtech has grown to a 35 strong company with a turnover of more than £6million. It has also made its first acquisition; a US company now provides it with a presence in a key global market.

Its products are shipped to hospitals and clinics around the world, where they form the front end of the eHealth revolution, while delivering multimedia entertainment to the bedside. JAOtech's sales in 2009-10 will be boosted by a contract with Hospedia, which has the potential to replace 40,000 units within three years.

Highly commended: Congratulations to Oxford YASA Motors, whose entry was highly commended.

7 New Electronic Product of the Year
Sponsor: Digi-Key

Winner: Atmel

Atmel developed maXTouch technology to provide the opportunity for manufacturers of mobile phones and other consumer electronics products to design multitouch user interfaces into their offerings. The aim was to create a competitively priced solution which provided the required performance.

In designing the device, specialised capacitive sensing circuitry was developed, reducing external component count. Meanwhile, an on chip microcontroller drives the interface functionality. A high signal to noise ratio and rapid signal acquisition allows the device to consume less power and extend battery operating life. The design allows the device to spend most of its time drawing only stand by current.

Since maXTouch Mxt224 was introduced in September 2009, it has been designed into most smartphones, including Samsung's Galaxy S and Motorola's Droid-X. Interest in the interface is now growing in other market segments.

8 New Mechanical Product of the Year
Sponsor: WEG Electric Motors

Winner: JRI

With shortlisted entries ranging from a high tech vacuum pump to a heat resistant metal coating, the Judges had a hard task in picking the winner.

An important aspect was the technology used and the speed with which the design had been brought to market.

The Judges selected JRI's Vaios shoulder system, intended for use in shoulder replacement surgery. While similar products are available, JRI believes its offering to be the only modular system.

The system was developed following a review of available shoulder replacement technologies. This highlighted an opportunity to develop a product through collaboration with a university and a hospital. Using these clinical inputs, JRI used its manufacturing, design and commercialisation expertise to create the Vaios system, which brings a 60% reduction in component parts and a similar reduction in the level of instrumentation.

JRI says it has met the objective to produce a market entry product with substantial novel features that overcame clinical problems.

9 Young Design Engineer of the Year
Sponsor: RS Components

Winner: Mairead Kelly

Mairead Kelly has been with Dialog's Edinburgh design team since July 2008. Since then, she has been directly involved with two key innovations; the development of a low dropout regulator for a Class D Amplifier; and the development of a patent pending technique for noise suppression and echo cancellation in alow latency digital bypass circuit.

Kelly is keen to support new engineers and actively seeks opportunities to do this. She is passionate about developing business/academic links and encouraging young talent into the business. She is currently acting as a graduate mentor for an Edinburgh University placement student and Mairead is actively helping to promote engineering as a profession to school leavers and undergraduates.

10 Design Engineer of the Year
Sponsor: element 14

Winner: Andrew Burrows

Engineers are the people that make things happen. Sometimes it's about refining someone else's ideas but, occasionally, an engineer will take their own idea from concept to market.

Despite being collected, filtered and chlorinated, then being distributed via high pressure mains, 25% of water is lost before it reaches the consumer. Water leakage can be reduced by limiting pressure in the distribution system but, until recently, no effective technologies existed. Andrew Burrows has designed an intelligent valve, controlled by a central server, which learns the behaviour of the network and constantly adjusts the pressure to the optimum.

Burrows has jointly filed a patent for a valve whose innovative hydraulic feature enables it to be actuated 400 times per day for five years using only tiny amounts of energy. Contributing to the industry, Andrew Burrows finds time to mentor other engineers through non executive directorships at other companies.

11 Mechatronic Design of the Year
Sponsored by Rockwell Automation

Winner: Kohler Mira

Kohler Mira's brief was to create a next generation product that would give unrivalled accuracy of temperature control, parameter set up, customisation and access to data. Additionally, it was tasked with making a product with a higher flow capacity than previously products and one which was easy to integrate into a water control system.

The only product of its kind, the drv80 can monitor its operation and diagnose faults. It can also monitor a number of hot water system parameters and provide system maintenance information.

The product is now growing in significance to Kohler Mira's major customer and is substantially responsible for its customer's business enjoying a 23% annual compound growth.

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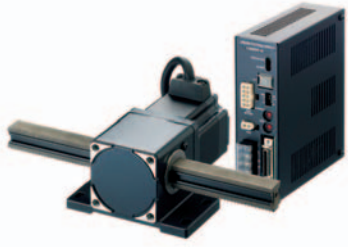

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Brushless motors achieve quiet efficiency

Tom Shelley reports on the benefits to be obtained by turning to new designs of permanent magnet brushless motors.

Brushless permanent magnet motors and drives are being developed into designs that can act as wheel hub, run almost silent without cogging and achieve speeds in excess of 400,000 rpm. While more expensive than induction and brushed motors, their higher efficiencies normally pay back price differences in months rather than years and can be used in environments where other motor types are problematic.

Dr Sab Safi of SDT Drive Technology in Southampton has prototyped integrated DC brushless motor/drive combinations that are almost silent. One such is a 150W continuously rated unit, 57mm in diameter, which produces only 35dB(A) of sound and a 350W continuously rated 87mm unit that can just about be heard running. Both motors are designed to run at up to 20,000 rpm and have integrated controllers so there are only two external wires in each case.

Their quietness stems from an avoidance of torque ripple. Dr Safi says: "Measures taken to minimise torque ripple include skewed slots, special shaped slots and stator laminations, selection of the number of stator slots with respect to the number of poles, decentered magnets, selection of magnet thickness and magnetisation distribution."

Since the cogging torque is produced by the PM field and stator teeth, Dr Safi explained that one needed to have a slotless winding to eliminate cogging torque. This, however, increases air gap, which in turn reduces the PM excitation field. To keep the same air gap magnetic flux density, slotless brushless motors use more PM material than slotted motors. To eliminate cogging torque without the need to skew or be slotless, he said that one needed to have a number of stator slots close to the number of rotor poles.

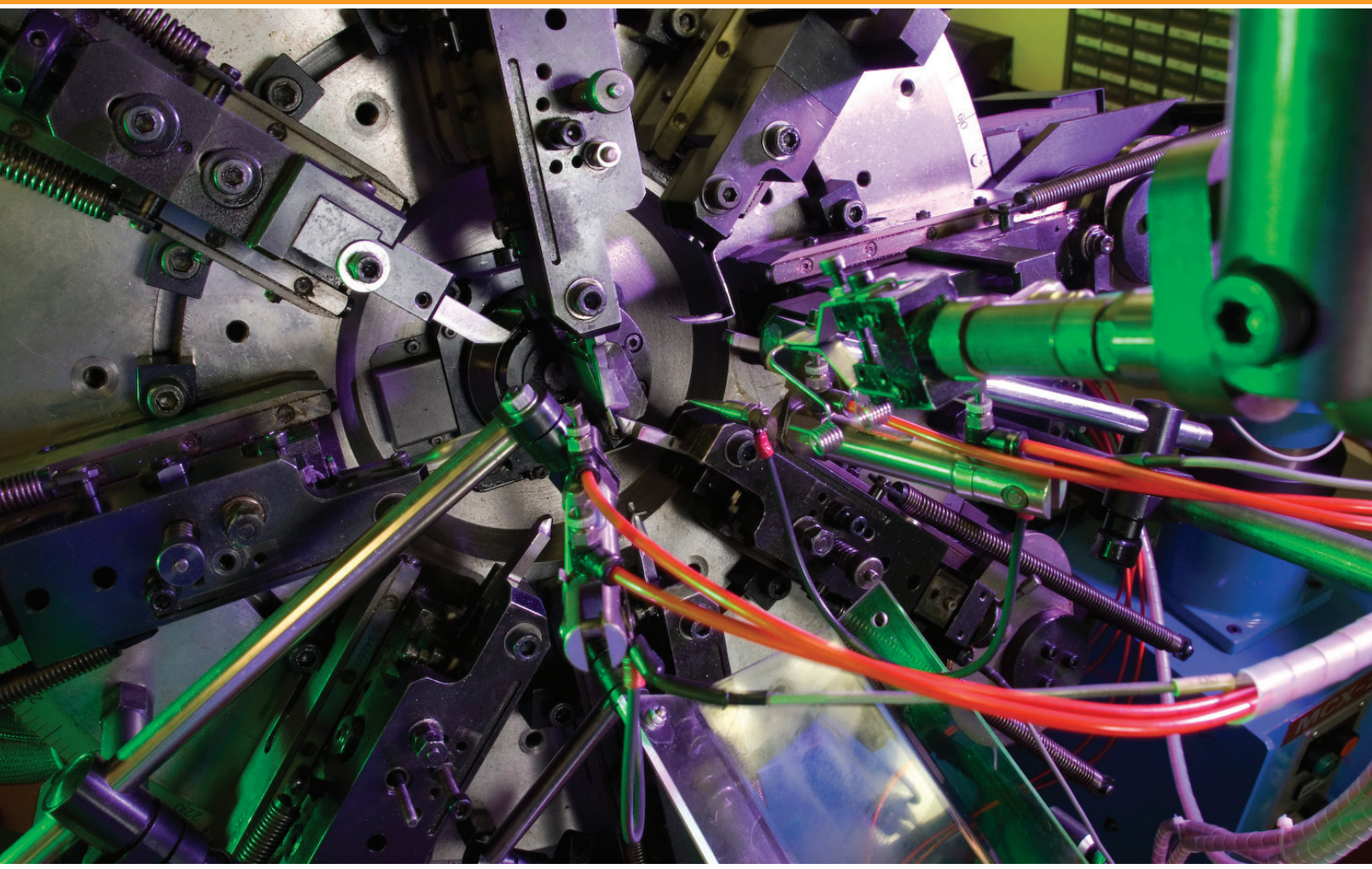
To further increase the capabilities of proprietary brushless PM motor systems, Dr Safi uses a technique which he and two co authors published in 1995, based on research work they had undertaken at the University of Newcastle.

This allows phase current to build up in a motor winding before back EMF reaches any significant level. He said this is "A step beyond the art of influencing electric-motor operating characteristics through various methods of weakening the motor magnetic field". In this way, electrical energy is taken from the supply and stored as magnetic energy as the winding current attains its initial high value. When the back EMF reaches its maximum level, mechanical output energy is obtained from both the electrical energy input from the supply and the magnetic energy stored in the windings.

The YASA motors described in Eureka's September 2009 edition as used on the Morgan concept LifeCar and the Riversimple cars use axial magnetic flux motors, with permanent magnets on rotor elements on each side of the stator coils. Dr Safi remarks that the ideal configuration is not clear, but for lower powers up to 1kW, suitable for wheelchair applications, he favours using radial magnetic flux, with the permanent magnets on a hub inside or outside the stator coils.

The large amounts of time and effort required to develop new designs of electric motor and make them efficient are a common theme in every conversation with developers. David Baillie of HT Servo displayed his latest frameless, brushless 'IntegratedThruster' at the recent Unmanned Underwater Vehicle Showcase and announced that his 32N thrust, 108mm diameter units are now fully 'productionised' and in service to provide the ability to hover in a new version of the Hydroid Remus 600 autonomous underwater vehicle. The thrusters were originally invented by Dr Suleiman Abu-Sharkh at the University of Southampton and described in a series of papers dating from 2001 to 2004.

The motorised thrusters have no shafts, and use permanent magnets in a hub in whose centre is the propeller. They employ a sensorless drive which monitors rotor position from back EMF. Baillie said that this is sufficient to allow good speed control down to low speeds. The company also offers designs



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ranging from a size 50, 79mm in diameter, with a thrust of 25N up to a size 300, which has a diameter of 384mm and produces thrust of 2500N.

Development times would be even longer if it were not for design software. Air Bearings of Poole uses Opera from Cobham Technical Services to allow it to extend the speed of its brushless spindle motors for printed circuit board drilling to beyond 400,000 rpm. Over the last decade, speeds have increased from 80,000 rpm to 350,000 rpm, allowing more than ten vias and holes to be drilled per second. Increasing rotor speed still further depends largely on reducing rotor mass, which has required going from induction motors to permanent magnet types.

Opera incorporates integrated thermal modelling, which provides the means to predict temperature changes in the air bearing-mounted rotor. Integrated electromagnetic and thermal solvers help predict and minimise harmonic losses, which can be substantial as a result of the need to use solid, non-laminated rotors. In addition it is possible to calculate and so reduce or eliminate induced eddy currents in metallic components that are in close proximity to the rapidly rotating magnets.

The bottom line, according to Neil Russell, the company's R&D manager, is: "The design automation now gives us great confidence that we can improve design throughput substantially, by between five- and ten-fold with the same head count."

But as well as permitting greater rotation speeds, the other big advantage that permanent magnet motors offer is greater efficiency than induction motors. Because there are no resistance losses in the rotor cage bars, there is no need to induce current. In addition, permanent magnet motors work efficiently at low speeds, so for low speed applications, there is no need for a reduction gearbox.

Julien Ollivier, marketing energy efficiency for Baldor says his company has for some time been selling a permanent magnet motor and drive system specifically targeted at cooling towers. Motor efficiencies are typically 97% over the load range 60% to 100%. Tests on two identical cooling towers at Clemson University in South Carolina in the US showed that the new system achieved input power savings of 11.8% compared to a traditional geared system, with high speed noise reduced from 82.3dB(A) to 74.4 dB(A) and reduced vibration.

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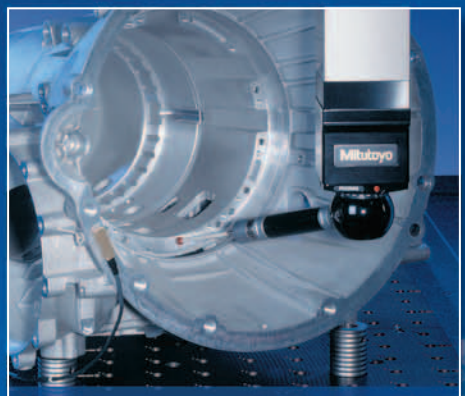
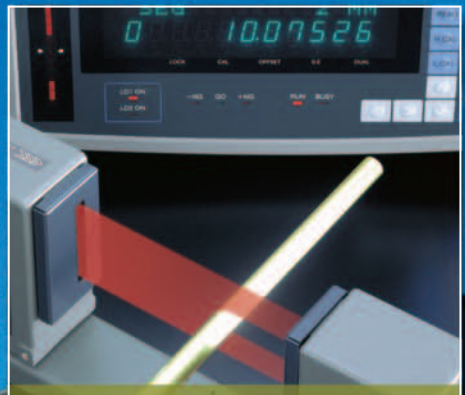


Coordinate Measuring Machines

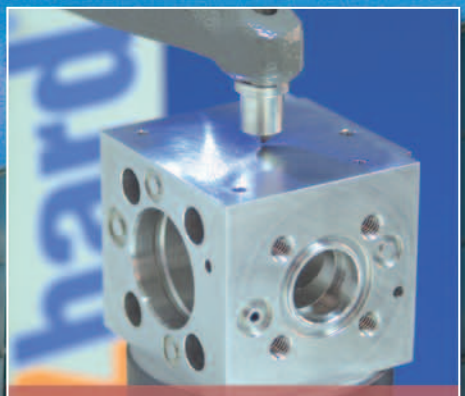
Vision Measuring Machines

Form Measurement

Optical Measurement



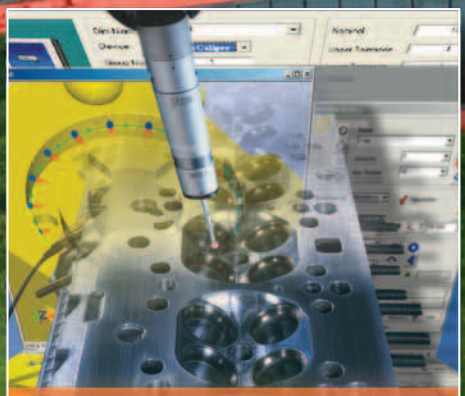
Sensor Systems



Test Equipment and Hardness Testers

Digital Scale and DRO

Small Tool Instruments



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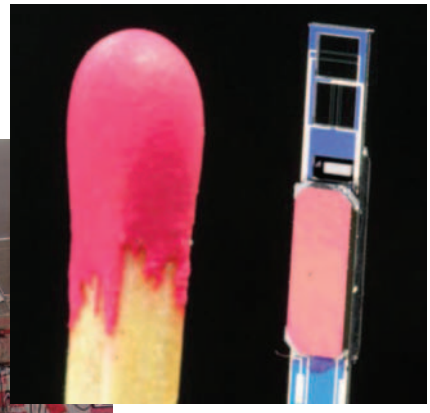
Threads locate noises in air and water

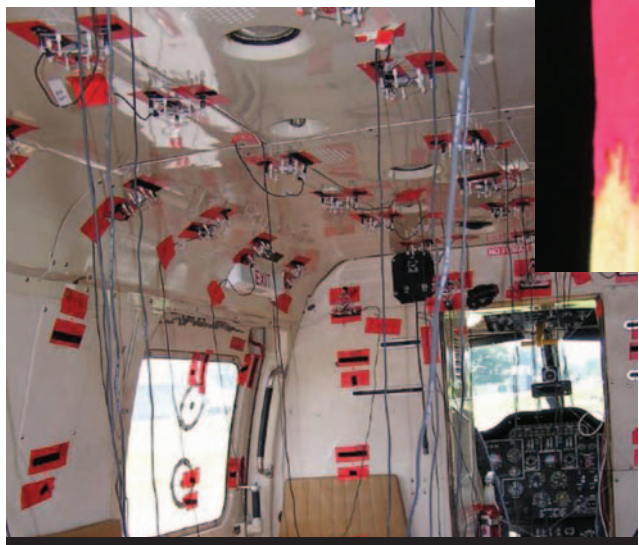
Tom Shelley reports on a clever way of locating sound sources using micro engineered arrays that would fit in a match head.



A Dutch company has a sensor technology based on pairs of very thin platinum wires on a single device, that can accurately locate sources of sound both in the air, and recently, underwater.

The devices have for some time been used by automotive engineers to locate noise sources on cars under development, but they also have applications in defence for locating and identifying enemy weapons fire and incoming aircraft and a new family of devices can locate noise sources under water. These have potential applications in the defence and offshore oil and gas industries.

The basic technology was originally invented by Hans-Elias de Bree at the University of Twente in the Netherlands in 1994. He earned his doctorate in 1997 and started Microflown Technologies in 1998. John Bremner, the company's business development manager, says that the wires, which are thinner than human hairs, are heated to 200ºC. Particles of air of water crossing them are heated by the first wire, taking heat from it and thus reducing its electrical resistance. When they cross the second wire, they are heated again and also cool it, but by a smaller amount. This allows calculation of the flow rate past the wires. If there are three pairs of wires arranged orthogonally, it is possible to determine the speed and direction of the movement of air or water. Sound waves cause air or water to move in a reciprocating manner whose frequency can be detected. Hence, by processing the changes in resistance of the wires in real time, and combining this information with the output of a microphone, it possible to determine the direction of a sound source, and identify what sort of sound it is and how far it is away. The combination of microphone and three flow sensors is called by the company an 'Acoustic Vector Sensor' or AVS. If the flow sensors are working in air they are referred to as 'Microflown' sensors, and if they are working in water, 'Hydroflown' sensors, in which case the microphone is replaced by a hydrophone.



The ability to locate the source of sound has a variety of applications

It is possible to make a single AVS only 5mm x 5mm x 5mm. Angular accuracy is within +3°. Sensitivity is from -10dB to +170dB and frequency response is from 0.1Hz to 120kHz, although for civilian commercial applications, the bandwidth is limited to 1Hz to 20kHz. In air, if distance is to be established for military purposes, it is possible to achieve +50m over a range of a "Few km." The first and main users of the technology are automotive engineers set with the task of locating the sources of noise in new cars, with a view to eliminating them before they go into production. There has been much research and development into systems to detect, identify and locate enemy small arms, mortars, artillery, fixed wing aircraft and helicopters. Because the system is passive, there is no need to use radar, whose signals may be detected by the enemy.

Underwater, where the AVS units are thumb sized, it is possible to locate ship and submarine propeller noises, so enemy vessels can be located passively without having to use sonar, which can also be detected by the enemy. They also have the potential to replace towed sonar arrays with items that are orders of magnitude smaller and lest expensive. In the oil and gas industries, they have the potential to be able to quickly locate leaks and developing problems.

www.microflown-avisa.com

Sensors identify plastics for recycling

Tom Shelley reports on a sensing breakthrough that enables reliable sorting of all plastics for recycling.

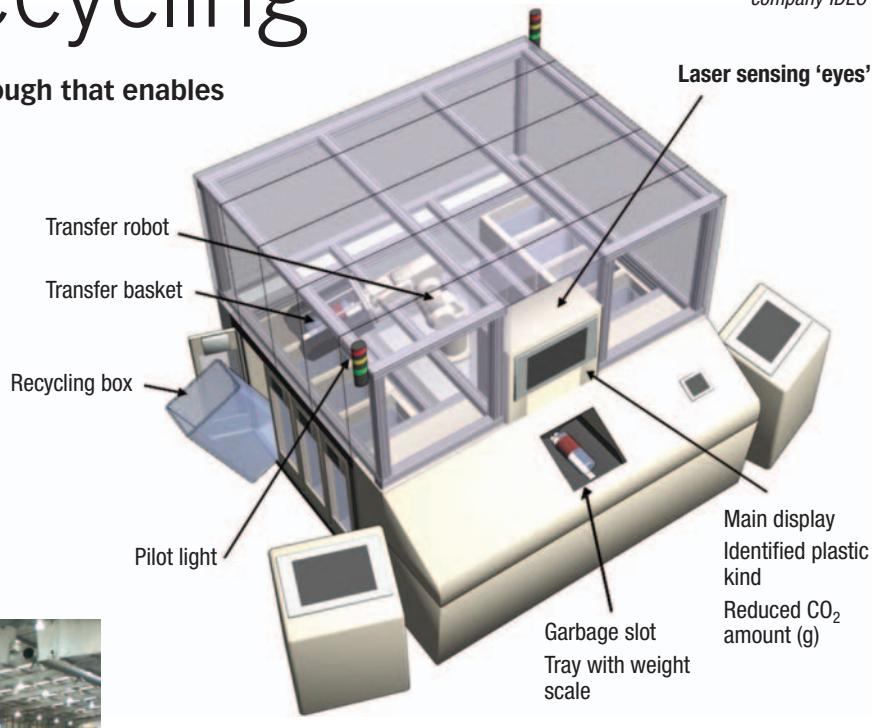
While infra-red sensors have been in use for some time to enable fast sorting of two or three plastic streams for recycling, the latest developments allow the rapid recognition and reliable separation of six different plastics at the same time using near infra red laser diodes and detectors.This enables the practicable and cost-effective recycling of mixed plastic waste streams.

The need arises because different polymers do not usually mix in the molten state, and even when they do, the mechanical properties of mixtures are greatly inferior to those of the pure materials.

The Bywaters plant uses a system that separates PET and HDPE

European law requires that different plastics be identified in products to assist separation and recycling, but practical recycling of plastic waste from municipal sources requires automated separation. At the Bywaters recycling plant at Lea Riverside in East London, a near Infra-Red system made by Norwegian company Titech, identifies and separates PET – polyethyleneterephthalate, as used in plastic bottles, and HDPE – high density polyethylene. Furthermore, there have for some time been machines that can sort clear and coloured plastic flakes by using visual sensors and air jets to separate material into different bins, such as the Sortex Z+, made in East London.

A new, five-diode laser sensing system has been developed by the Japanese company IDEC



A new, five-diode laser sensing system has been developed by the Japanese company IDEC, and has been demonstrated on an industrial robot equipped recycling system developed by Mitsubishi Electric and the Osaka University Photonics Research Center.

The Center comments that in Japan: "Nowadays, only PET and PS are recycled but their production rates are low; 5 and 7.6% of the total plastic production, respectively. PE and PP have not been recycled as they are not distinguishable by eye, though their production rates are the highest; 23 and 22%, respectively." The information available is limited, but a paper published by Koji Inada and other IDEC researchers reveal that the sensing system depends on Indium gallium arsenic phosphorous laser diodes (LDs) and receptors, producing a system that is a small fraction of the size and cost, and much faster than any of the types of infra red spectrometer conventionally used for identifying plastics and other organic materials.

The paper describes using the ratio of absorptions at 1722nm, produced by the LD, and visible light from a LED at 644nm, and from another LD at 673nm, to distinguish PET from PVC – polyvinyl chloride. It also notes, however that it is possible to change the wavelength produced by the infra red laser diode by varying its composition and fabrication, and that by using a combination of LDs operating at different wavelengths, it is possible to distinguish between HDPE, Low Density Polyethylene (LDPE), Polycarbonate (PC), PET, polypropylene (PP), polystyrene (PS) and PVC.

According to the paper, the cost of a simple LD based system should be about YEN 500,000 =£3,800 and it would measure 50mm x 100mm x 100mm. Source lifetime is estimated at 100,000h, response time, 0.05ms and dissipation power 5W.

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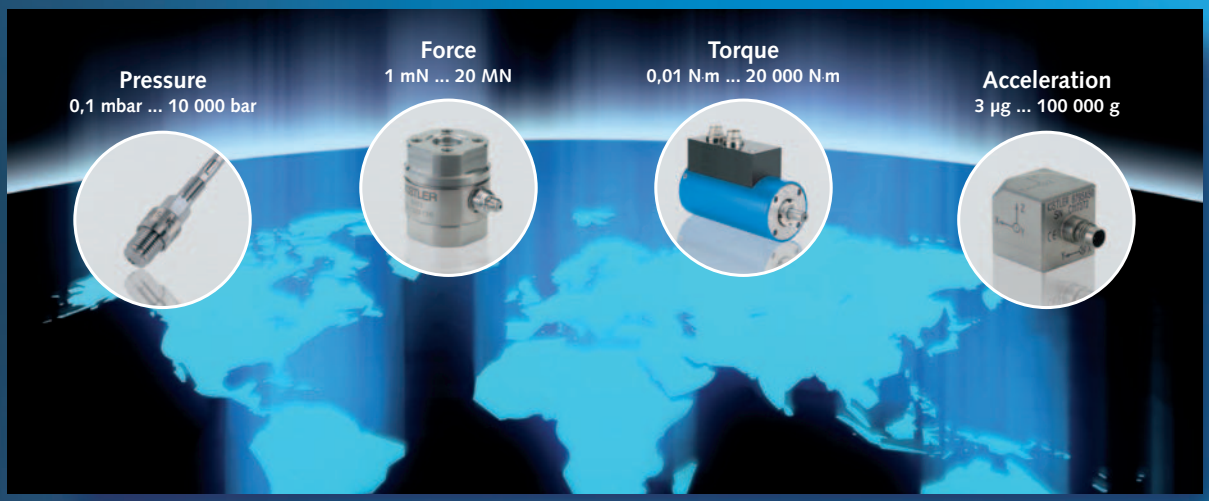

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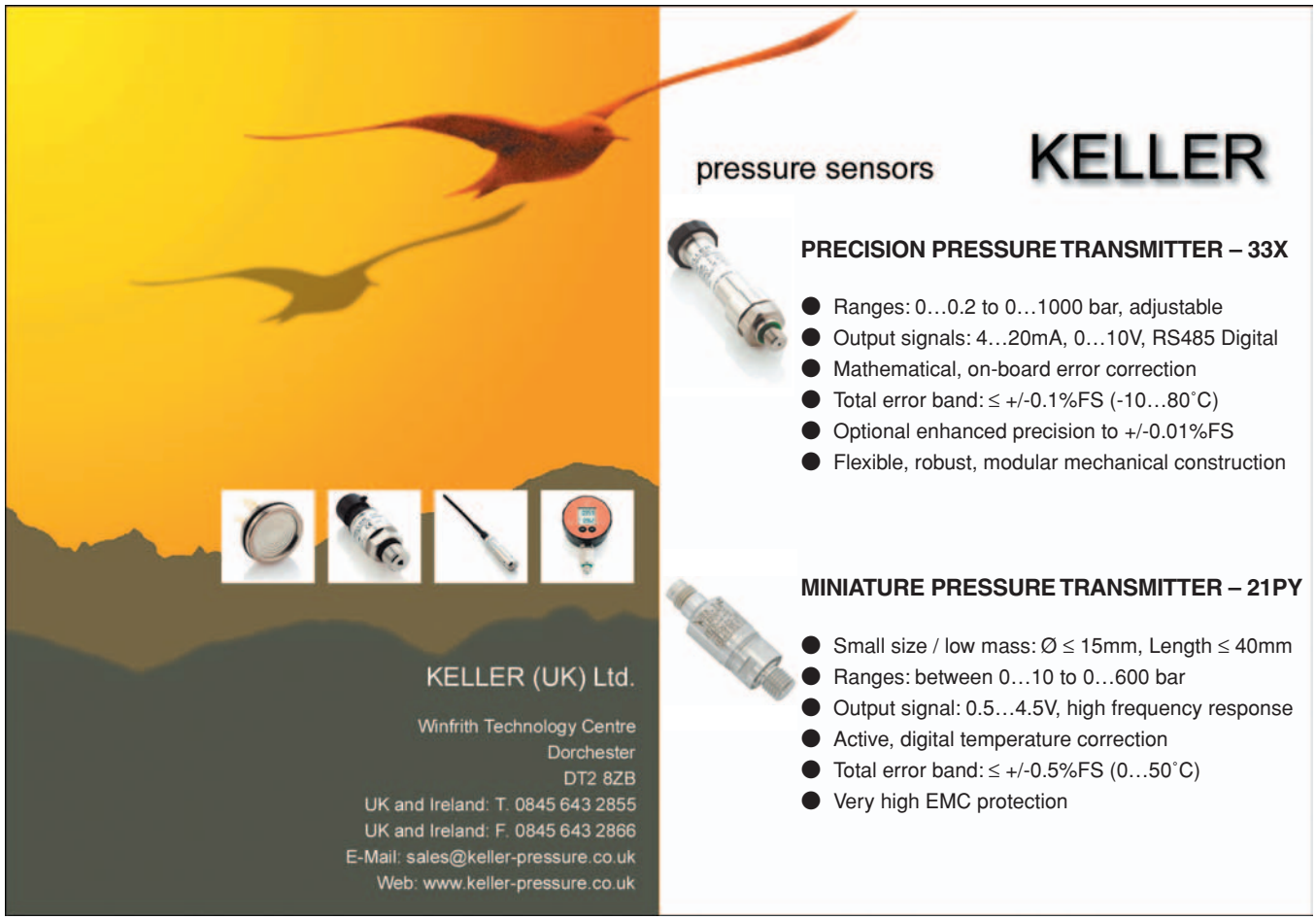


Solid Edge designs in flexibility

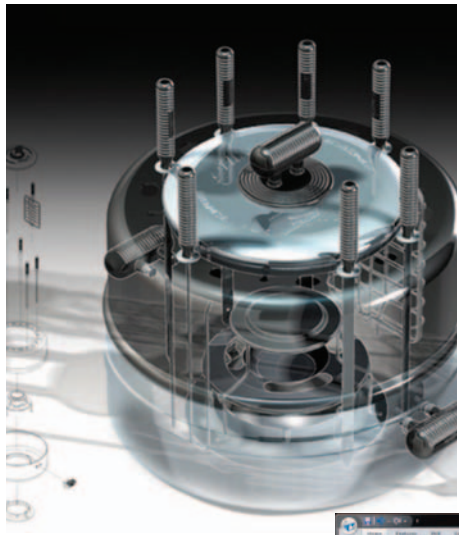
Tom Shelley reports on a step forward in CAD.

Solid Edge ST3 (the 'ST' standing for 'Synchronous Technology'), allows users to move between what is called 'Ordered' designing, where step-by-step operations are maintained in a feature tree and the Siemens PLM 'Synchronous' approach, which does not.

The same model can have ordered and synchronous branches, but once one moves out of the ordered environment, by taking hold of features and moving them about – there is no switch to change from working in one way to working in the other - it is not possible to put them back into an ordered form.

"For some approaches", says Solid Edge's Russell Brook, "ordered is better than synchronous, but for others, it isn't."

To make design changes to a model produced by somebody else, the traditional approach requires identifying the appropriate point in the feature tree and go back there to make the modification, which then ripples through to the final model, hopefully changing it in the right way. This is usually complicated by the fact that no two modellers produce geometry in exactly the same way, so it is not always obvious to the person making the modification, how the original designer produced the model. If the geometry is very complicated, such as in, for example, an engine block, there may be instances where the design process as stored in the feature tree is so difficult to unravel that it is quicker and easier to create the whole model again from scratch, whereas the synchronous technology allows quite major changes to be made with a few mouse clicks.



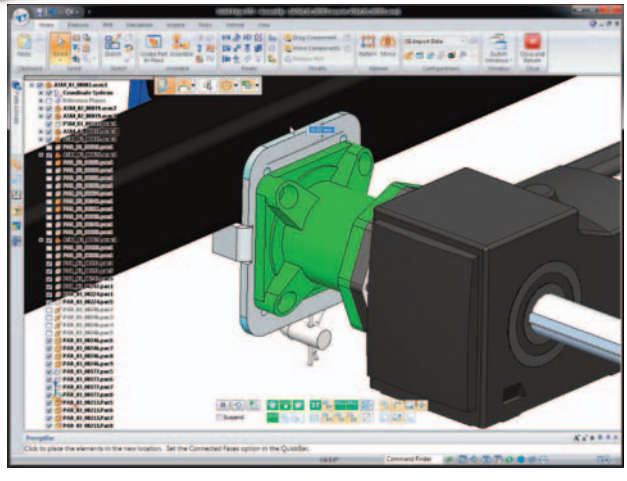
On the other hand, holes and surfaces are best handled in an ordered manner, and the software will not allow them to be processed in the synchronous environment.

In demonstration, surfaces were generated by creating a Bezier curve and an arc, joining them at a point represented by a blue dot. The dot and points on curves used to create the surface could be moved around, but the surfaces are not completely free form. Solid Edge is primarily a tool for mechanical engineering, not conceptual industrial design, a role intended to be fulfilled by the other Siemens PLM product, NX.

Brook says that the latest enhancements are also being rolled out in NX, but by a separate team of developers, so it is, "Not always implemented in the same way".

Other enhancements in ST3 include improvements in sheet metal, piping and frame management, assembly management and drafting.

Added features in sheet metal include new closed corner types, etching of part numbers and other geometry, and tabs added for production or transport purposes. In drafting, all manufacturing dimensions and annotation, including item numbers can be embedded in the assembly, and multi-cultural drawings allow mixing of character sets from multiple languages on a single drawing or in a single annotation. Prominent during the demonstrations was a new customisable radial menu, and the Insight data management and collaboration tool now takes full advantage of Microsoft SharePoint 2010.



Simulation, which was added in ST2, is based on Femap, and uses the same underlying NASTRAN technology as full Femap. The ST3 version includes new torque and bearing loads, user defined constraints and new ways to connect assemblies such as bolt and sheet metal edge connectors.

www.siemens.com/plm

Design Pointers

- SolidEdge ST3 combines traditional feature tree-based and synchronous non-feature tree-based modelling in the same environment.
- Models can incorporate both feature tree based and synchronous based branches. There is no switch to go from feature tree-based to synchronous modelling, which is initiated simply by pulling on faces and features.

Not reinventing the wheel

Tom Shelley reports on progress in locating lost knowledge and preventing it from becoming lost in the first place.

Before starting work on a new product, it is well worth ensuring that nobody has done any part of it before, and if they have, learning all possible from previous designs and intents.

The first move, might well be a quick search with Google, but despite its vast database, there is a great deal of data that is not accessible online, and most companies have some kind of archive which has never been digitised.

Furthermore, although patents can be searched online both using the facilities of both the US Patent and Trademark Office and the European Patent Office, it is often very difficult to locate old ideas without knowledge of who invented them and what they were trying to do.

It is said that a really well written patent protects all aspects of an invention, while making it as difficult as possible for others to understand. This is not the case with inventions made within a company, but information held in old reports and documents can be difficult to locate.

Dr Ian McGill, presently with Oakdene Hollins, but formerly the director of the International Tin Research Institute, ITRI, recently addressed a seminar in London on 'The reinvention of technologies for sustainability'. In this, he explained how he has had the entire ITRI archive scanned and digitised so that the current generation of researchers could investigate it to find items that might be of use that may or may not have been considered useful at the time, but could be extremely useful now.

Going back to 1932, this archive includes some 40,000 scientific papers on Microfiche, 80,000 card indexes to scientific papers and 5,000 documents in filing cabinets. In all, there were 826,400 pages and the paper weighed 83 tonnes. Despite the size, the cost to provide access was modest: £10,000 to scan in the card indexes, £75,000 for scanning and document indexing, and £15,000 for hardware and software. The end result of this is a database of searchable PDF files, much of which is now available online as the Institution's 'Tindex'.

Established engineering companies too, are becoming increasingly concerned about loss of knowledge and time wasted by re-inventing things that have been done before as well as the re-exploration of dead ends and the remodelling of geometry and parts that have been designed before.

Recognising this need, all the major CAD vendors include searchable databases and search engines. Dassault's V6 portfolio allows searching for a particular geometry as well as names, using facilities such as 'Enovia 3D Live Similarity'. One of the latest companies to embrace the company's full V6 portfolio is US electric sports car maker, Tesla Motors, which already uses Catia PLM Express and Enovia SmarTeam but are now implementing Enovia V6, Catia V6 and Delmia.

Geometry search is also available with Siemens NX PLM products using 'Geolus' and there are in addition, geometry software specialist companies such as ShapeSpace and Bingo.

One answer to preventing technical developments becoming lost, however, is to make them truly memorable, by producing the best possible graphics to illustrate them. To this end, Luxion has recently announced the release of Keyshot 2.1, which supports SolidEdge, Autodesk Alias and Pro/Engineer.

www.oakdenehollins.co.uk
www.itri.co.uk/tinfacts/tindex.asp
www.3ds.com
www.bingo3dsearch.com
www.luxion.com

Design Pointers

- The best way to provide access to old documents would appear to be to scan them in as searchable PDF files
- Search engines are built into all current CAD and PLM packages or are available as third party add ons, enabling both word and geometry based searching

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READER INTERVIEW

LESLEY SELSDON
FOUNDER
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60 SECOND

Q How did you get into engineering?

A We originally had a family plastics business many years ago making fountain pens and ballpoint pens – and that's how I got involved. I went to Switzerland to learn toolmaking on automatic screwcutting machines to make ballpoint tips.

Q How did you get started in the field of oil filtration?

A We sold the plastics business and someone came to me about an oil filtration system using what was essentially a toilet roll in a housing and originally backed by Sir Monty Finniston, the chairman of British Steel. I had a look at it and thought 'this is interesting'. I thought the way they were doing it didn't look very elegant, being a great big pot with pipes coming out of it. I had the idea of making it like a silencer on a gun – getting a conventional oil filter and making a bypass housing between that and the engine so that you combine the best of both worlds. I finally got a patent on that idea and it worked and was very successful. The Royal Mail and Avis used it.

Then I sold that original technology 15 years ago and, in the meantime, technology moves on – and the media moves on considerably. Now, I'm using a completely new medium as cellulose, which was the original one, is very good, but only holds two or three times its own weight in water and is very dense and heavy, so requires a huge pump to push the oil through it.

New super-absorbent filter media had come along, which could hold 15-30 times their own weight in water and is 90% air, so the end result is that you have pulled out loads of water, don't need a huge pump and you don't have pressure drops. It combines purification – removal of water in this case – with filtration down to 50 ppm in the same housing and we don't have the expense involved in installing it.

It's the difference between a valve and a transistor – it's a quantum leap that changes the game.

Q How have you taken the technology forward?

A What started the latest application for me was my involvement with JCB. I was really concerned with oil filtration for automotive. However, they weren't because they were buying spin-on oil filters as a commodity. What they were concerned with was water in hydraulic oil. I felt I had the answer and they backed me and bought some of the original 'Oil Genie' products in a case and they were very pleased.

I went back to the drawing board and I wasn't satisfied with the original design because it had a peristaltic pump. That was fine, but it rocketed in price and had design problems in terms of the flow rates. So I went back to the drawing board and got this proof of concept award and, through funding from the EU, Warwick University and Coventry University, I've been able to buy the latest testing equipment, including the latest Karl Fischer machine and the latest particle counting machine. We've redesigned the whole thing so that it's simpler and better than it's ever been before.

There's also a big environmental aspect to the filtration process. because of the need to filter out mutagens from lubricating oils. I realised early on that used lubricating oil is very dangerous because of the number of mutagens produced in petrol and LPG engines. However, that wasn't the case for diesel engines. The reason was that the soot produced by incomplete combustion in a petrol engine was pulling the mutagens out and effectively acting as a filter.

Q How do you plan to market the product?

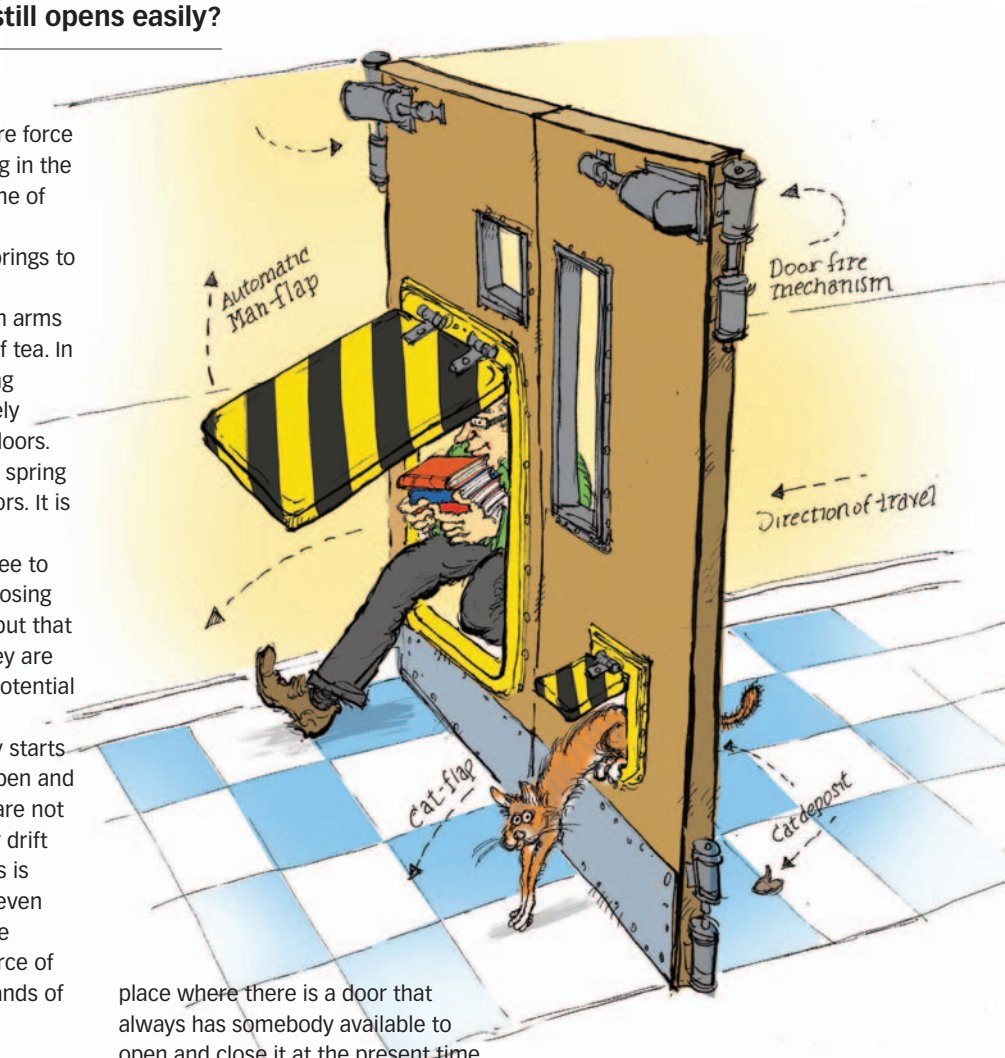
A I hope by the end of the year to be able to invite those who are interested in the idea to a presentation at Warwick University.The business model has three scenarios after that. We could offer the service and not sell the product, or we could offer the unit plus the replaceable elements or we could offer it as a one-off, disposable unit. I'm not yet sure which way we're going to go with it.

Q What has kept you interested in this technology?

A The intellectual challenge is a big part of it. Once you're an inventor, you're an inventor – it's in the blood. It's a tortuous route, though. It's not a straight line.

Holding the door

How can you make sure a door is closed when you need it to be, but still opens easily?



There are fire doors that require force to open them, doors that swing in the wind, and doors that slam. None of these are satisfactory.

Fire doors with powerful springs to keep them closed are a major problem when users have both arms full of files, shopping or cups of tea. In many offices, they end up being wedged open, which completely negates their function as fire doors.

Do away with the powerful spring and they become ordinary doors. It is possible to come up with a mechanism that is normally free to move yet activates a strong closing force when a fire is detected but that still leaves problems when they are free to move. There is also a potential hazard if somebody is passing through the door if it suddenly starts to close. If doors are free to open and close, on the other hand, but are not carefully hung, they can easily drift open or slam in a draught. This is annoying in most homes, but even more so in a care home for the elderly, and an irresistible source of major sound impulse in the hands of teenagers.

The Challenge

Our challenge this month, therefore, is to come up with a door closing mechanism that closes firmly in the event of a fire, without risking the health and safety of anyone passing though it at the time, yet in normal use, is easy to open and close with minimum force. Yet, at the same time, it should not be possible to slam it, in the hands of either angry teenager or an elderly person suffering from dementia.

The real answer, is, as in royal palaces when monarchs held real power, to have doors opened and closed by flunkeys. About the only place where there is a door that always has somebody available to open and close it at the present time in the UK is Number 10 Downing Street, but that is not a facility available to most of us.

It is possible to have doors that open and close when they detect humans. An increasing number of shops and institutions have them. Apart from the cost, they do have the tendency to open when somebody stands near them, who happens to not want to pass through the door, so an ideal control system, would have to respond to either the voice of the user, or detect their intention in some way.

The alternative is to have something clever but simple in the door closing mechanism. We do happen to know of one that solves the problem most elegantly, making use of traditional British engineering technology principles, which we will describe fully in our next edition. It works reliable and is patented. See if you can come up with anything better.

The answer to last month's Coffee Time Challenge of how to design a device for cleaning up oil can be found in our Technology briefs section on page 8.

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Array Sensors

New Sick Array Sensor Sets High Web Detection Standards

SICK's new compact Ax20 array sensor delivers high performance web positioning and edge detection solutions for the printing, packaging and textile industries. The scanning opto-electronic system offers repeatable automated object detection with a resolution down to 50 microns, allowing precision control of web position even at high operating speeds.

David Hannaby, Product Manager, Imaging and Measurement, SICK (UK), commented: "The Ax20 operates from one side of the web only, the measuring range of up to 30mm eliminates the need for fine adjustment and the visible light spot facilitates accurate alignment, without the need for teach in.

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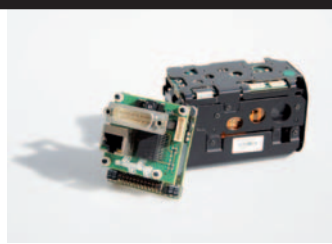
www.sick.co.uk

Cameras

GigE Vision Capability for Sony FCB E Series Camera Range



GigE Vision and GeniCam standards committee member, STEMMER IMAGING, is delighted to be able to announce the versatile performance of the new Sony FCB E Series of colour block cameras with GigE Vision and GeniCam functionality. The new CVC GE family includes a camera equipped with an FGI GigE Vision-compliant interface board produced by STEMMER IMAGING and the CVB CameraSuite software development kit. The CVC-1020P GE will be demonstrated for the first time at the Vision Show in Stuttgart, Germany, 9-11 November, 2010 and will be available for shipment early in 2011.

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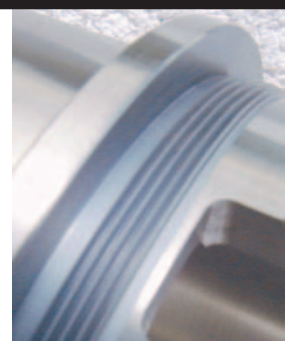
Coatings

WS2 Stops galling of SS and Titanium



Stainless Steels and Titanium are both prone to galling and seizing. WS2 is a very low friction dry lubricant surface treatment, developed by NASA for use in deep space. It has been shown to provide a very cost effective solution, preventing both problems on threads and other sliding surfaces.

WS2 works well from -273° to 450° C and down to 10-14 Torr. WS2 has been applied to bearings and gears to extend life.

Design Out maintenance problems with WS2!

@: sales@ws2.co.uk
✆: 01430 861222

www.ws2.co.uk

Cutting Fluids

Cutting fluids without bacterial growth

Henkel has developed two innovative, water-miscible, bactericide-free cutting fluids that are easy to use, reduce health risks to employees, and implement prospective EU Biocides Regulations.

Known as Multan 71-2 and 77-4, they incorporate a new technology that prevents bacteria from absorbing nutrients from the degradation of emulsifiers.

Multi-functional Multan 71-2 has a high lubricity formula which makes it suitable for general machining, including grinding.

For high-alloy steel and aluminium requiring specialist machining, specialist Multan 77-4 provides extremely high lubricity even at low concentration.

@: technicalservice.loctite@uk.henkel.com
✆: 01442 278100

www.loctitesolutions.com

Design Space to Rent

Available to rent 350 sq metre high specification office space

aero tech
PRECISION MANUFACTURING LTD

Currently laid out as a design/engineering department, photographs can be viewed at www.aero-tech.co.uk/do

Ideally the space would suit an OEM/Design team who could utilise this facility which would be mutually beneficial to both parties and subsequently this would be reflected in the terms of any rental/lease agreement.

For further details please contact Roger Foley.

@: roger.foley@aero-tech.co.uk
✆: 01202 848484

www.aero-tech.co.uk/do

EasiHeat™ systems

Spirax Sarco EasiHeat™ systems 'free up a fortnight' for Kent hospital

William Harvey Hospital is saving two weeks a year in maintenance time by switching its domestic hot water supplies from shell-and-tube heat exchangers to EasiHeat systems from Spirax Sarco.

Because they are based on plate heat exchangers, EasiHeat systems do not have to be stripped down each year for insurance inspections. "The insurance cost itself wasn't a lot, but the craftsmen's time was the big thing," says Estates Manager Len Hobbs. "That time is now devoted to improving the patient environment by carrying out other maintenance work around the hospital."

The hospital in Ashford, Kent, currently has eight EasiHeat systems. The two most recent additions mean that the entire domestic hot water supply is now provided by the Spirax Sarco units.

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www.spiraxsarco.com/uk

Electric Atomisers

Fine Droplets without High Pressure

The small electric rotary atomiser produced by Newland Design is an efficient way of creating small, consistently-sized droplets by means of high-speed rotation alone, without need of compressed air or any high pressure.

The Newland Atomiser rotates a small porous plastic cylinder at speeds up to 35,000 rpm and emits droplets of less than 40 micrometres in diameter.

Applications include:

- Humidification and Evaporative cooling
- Gas scrubbing and Odour control
- Dust suppression
- Oil misting.

Flow rates up to 25 litres per hour. Power input 10 - 25 Volts DC, consumption less than 40 Watts. Evaluation units always available.

@: newland.design@btconnect.com
✆: 01524 733 424

www.newlanddesign.com

Flowmeters

Titan's Breakthrough in Small Bore Flow Metering

Titan Enterprises breakthrough product is now available from £464 EXC VAT!

The new 'Atrato' is a direct and accurate through meter without a contorted flow path which can operate over very wide flow ranges. The ultrasonic technology used offers excellent turndown, linearity and repeatability.

The Atrato is capable of monitoring flow over a range of 200:1 and has accuracy better than ±1.5%. It's simple, yet effective design makes it applicable to a variety of markets, whilst its USB interface makes it extremely easy to install and use.

@: sales@flowmeters.co.uk
✆: 01935 812790

www.flowmeters.co.uk

Instrumentation

Ixthus Instrumentation

Non-Contact Position Measurement using inductive, capacitive, ultrasonic, fibre optic or laser technologies. Measurement ranges from 50µm to 500 metres, resolution to 0.01 nanometre, frequency response to 200KHz, all with excellent environmental protection.

Force and Torque Measurement, miniature and fatigue rated loadcells, strain gauged bolts and clevis pins. Custom designs to meet your exacting requirements. Vibration Monitoring with switches, sensors and instrumentation for power generation and offshore applications. Ixthus provide full technical support for design, installation and calibration to all areas of industry for R&D testing, quality control and production requirements.

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www.ixthus.co.uk

Oxygen Analyzer

Michell introduces touch-screen oxygen analyzer

Michell Instruments has updated and improved its XZR400 range of oxygen analyzers to include an easy-to-use touch-screen interface.

Based on the MSRS (Metallic Sealed Reference Sensor) technology, the instrument detects trace amounts of oxygen very rapidly – within seconds for 90% of a step change. The metallic sealed reference makes the sensor resistant to pollution and virtually drift-free, reducing the need for calibration and maintenance.

The MSRS oxygen sensor is just one from Michell's portfolio of sensing technologies covering dew point, trace moisture and relative humidity as well as oxygen, for applications as diverse as plastics, gas manufacture, aerospace and pharmaceutical.

@: uk.info@michell.com
✆: +44(0)1353 658 000

www.michell.com

Pressure gauges

Pressure gauges made of Monel® in overpressure safe versions

Bourdon tube pressure gauges in nominal sizes 100 and 160 with measuring systems made of stainless steel are available in overpressure safe versions. This overpressure safety can now also be realised for pressure gauges with Monel® measuring systems.

@: info@wika.co.uk
✆: 01737 644008

www.wika.co.uk

Pressure Sensors

New Stainless Steel Pressure Sensors Offer High Accuracy and Digital Outputs

Sensortechnics' new SSI stainless steel OEM pressure sensors accurately measure gage or absolute pressures in ranges from 200 mbar up to 35 bar. These devices offer excellent stability and repeatability, achieving a Total Error Band (TEB) better than ±1.5 %FSS over a temperature range of -20…+85 °C. Sensortechnics' SSI pressure sensors use precision digital signal conditioning and provide both analog 0.5…4.5 V output as well as digital I²C or alternatively SPI interfaces at the same time. Fully welded, media isolated rugged stainless steel constructions allow for high media compatibility with corrosive liquids and gases. Sensortechnics' customisation service can provide very fast and flexible mechanical or electronic modifications of its SSI pressure sensor series to fit each customer's application specific requirements.

@: uk@sensortechnics.com
✆: 01788 560426

www.sensortechnics.com

Sensors/Switches

Pressure level temperature and flow

Applications Engineering Ltd holds a comprehensive range of pressure, vacuum, level and flow switches. We provide 'tailor made', custom designed products, accessories and associated product lines including the Jetcleaner hose and pipe cleaning system.

We offer a 30 day sale or return sample service on our standard products. That way, you only buy when you are satisfied that the product suits your application.

More often than not, we are able to get a product to you within 24 hours of you making your first enquiry.

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✆: 01825 764737

www.appeng.co.uk

Spectrometers

New Near-Infrared Spectrometer Has Spectral Response from 900-2200 nm

Ocean Optics' NIRQuest512-2.2 provides great stability and high optical resolution

Ocean Optics (www.OceanOptics.eu) has expanded its offering of small-footprint near-infrared spectrometers with the introduction of NIRQuest512-2.2, a high-performance unit with response from 900-2200 nm. NIRQuest512-2.2 is ideal for applications ranging from moisture detection and chemical analysis to high-resolution laser and optical fibre characterisation. NIRQuest512-2.2 uses a high-stability, 512-element Hamamatsu Indium Gallium Arsenide (InGaAs)-array detector in a compact optical bench with two-stage thermoelectric cooler and low-noise electronics. Depending on the configuration – a half-dozen grating options and five sizes of optical bench entrance slits are available – optical resolution of ~0.5 nm-5.0 nm (FWHM) is possible. Higher-resolution setups are especially useful for characterising lasers.

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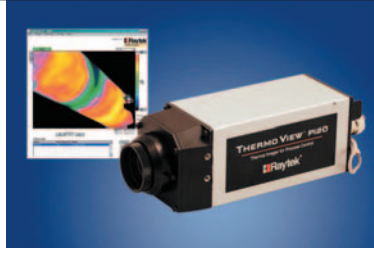
www.oceanoptics.eu

Thermal Imaging

Raytek® Introduces ThermoView™ Pi20 & DataTemp® Pi Process Imaging Solution



Simplified thermal imaging expands real-time view of industrial process performance.

August 2010 — Raytek®, a leading worldwide provider of infrared (IR) thermometry and maker of the industry-leading ThermoView Ti30 infrared camera, has introduced the ThermoView™ Pi20 process imager and DataTemp® Pi (DTPi) software. This easy-to-use thermal imaging solution provides an expanded view of process performance in a wide range of industrial applications.

@: info@raytek.de
✆: 01908 370000

www.raytek.com

IMPACT20 - 16 inputs or outputs in one small space

IMPACT20 is the new fieldbus I/O station from Murrelektronik! Thanks to a very small footprint and low height, IMPACT20 is perfectly suited for applications in terminal boxes and in control panels and other tight spaces.

IMPACT20 features:

- Predefined inputs and outputs.
- Port-related shutdown in case of failure.
- Diagnostic messages via the bus.
- Plug-in terminals with integrated LEDs for single channel diagnostics.
- CanOpen , DeviceNet, ProfiNet, EthernetIP, EtherCat, and Profibus.
- Input only, Output only and mixed modules.

Murrelektronik Ltd
5 Albion St, Pendlebury Ind.Estate,
Swinton, Manchester, GB
M27 4FG

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