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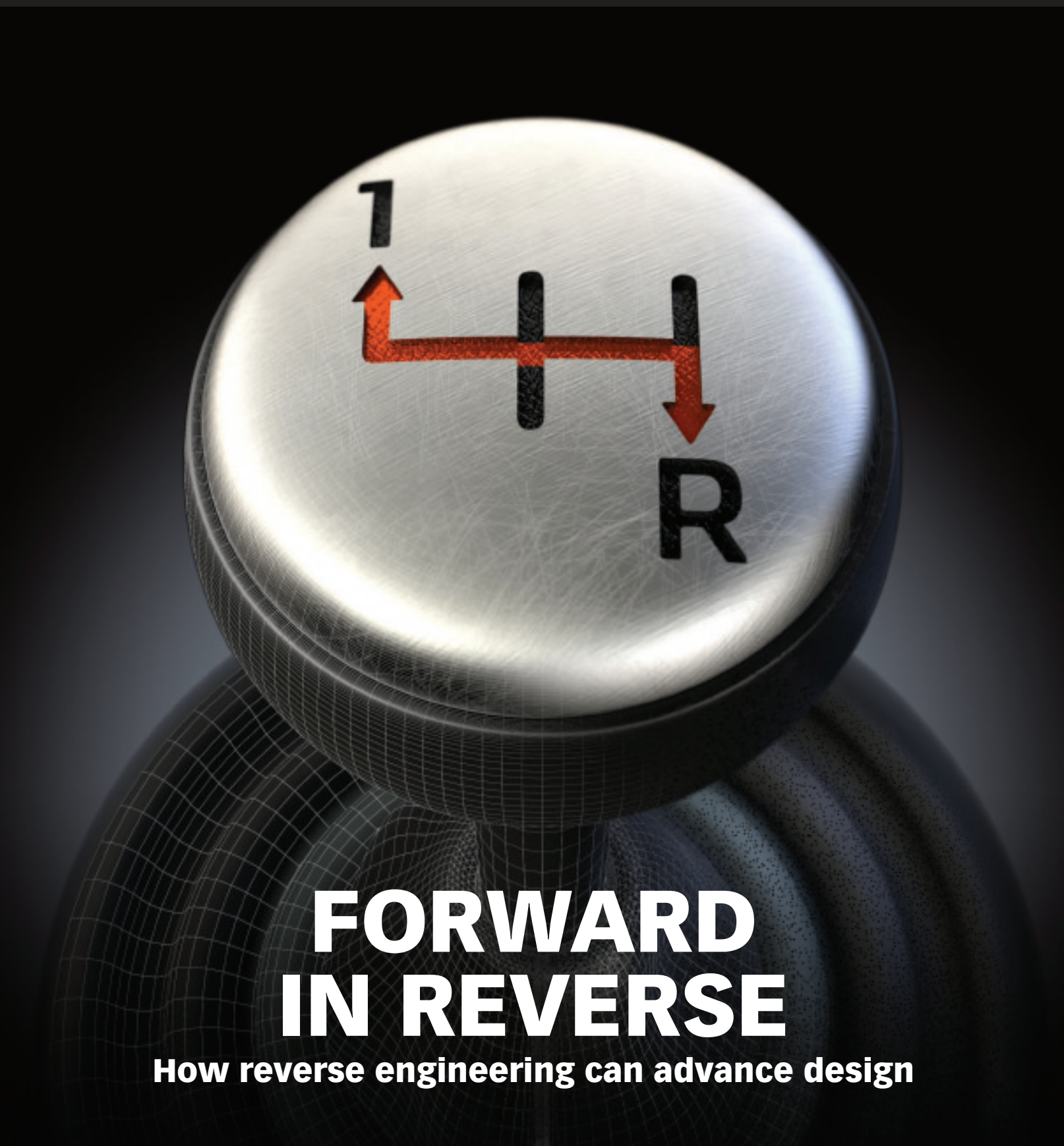
EUREKA

THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: Engineering Design Show Launch • Rapid Prototyping • Motors • Fastening & Adhesives



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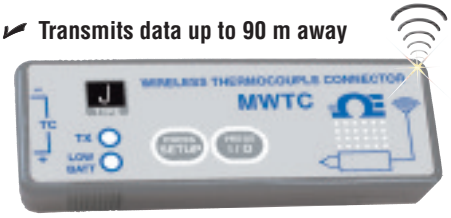

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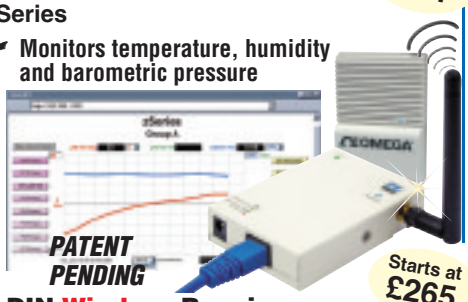

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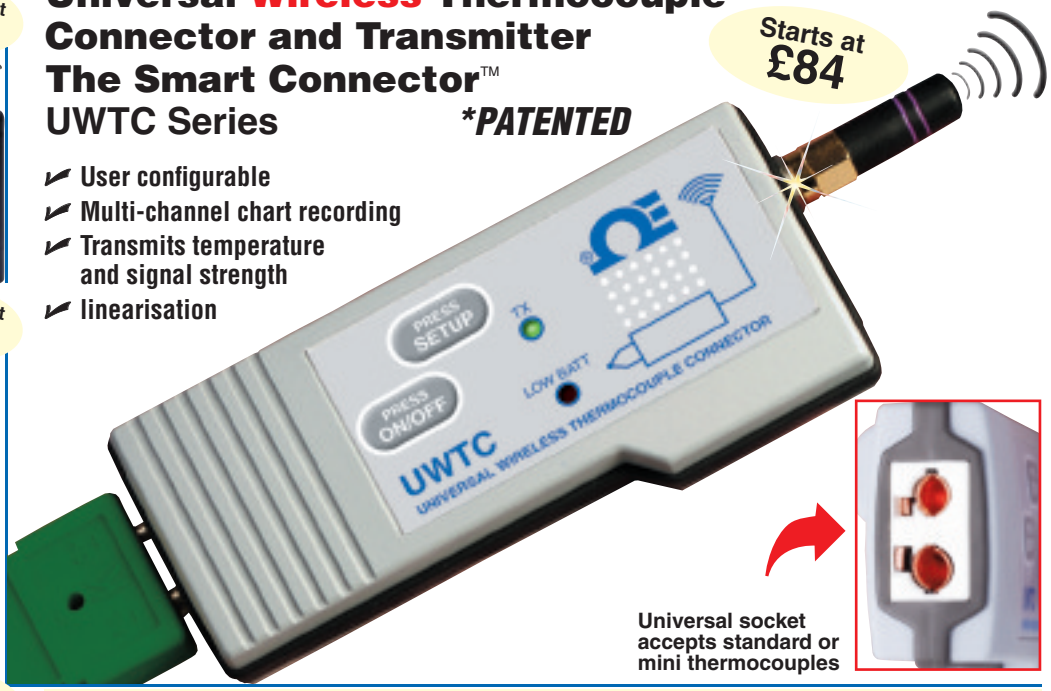

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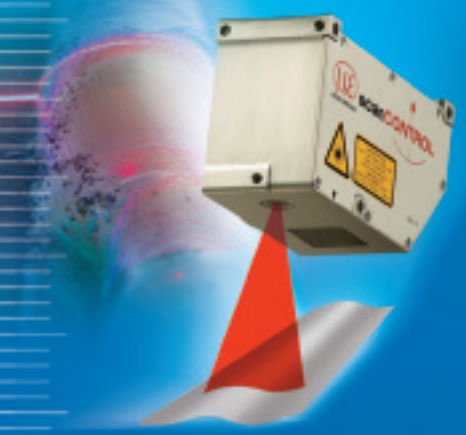

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Editor
Paul Fanning
pfanning@findlay.co.uk

Deputy Editor
Justin Cunningham
jcunningham@findlay.co.uk

Contributing Editor
Tom Shelley

Group Editor
Graham Pitcher
gpitcher@findlay.co.uk

Art Editor
Martin Cherry

Technical Illustrator
Phil Holmes

Advertising sales
01322 221144

Sales Manager
Luke Webster
lwebster@findlay.co.uk

Account Manager
Tricia Bodsworth
tbodsworth@findlay.co.uk

Sales Executive
James Slade
jslade@findlay.co.uk

Production Manager
Heather Upton
hupton@findlay.co.uk

Circulation Manager
Chris Jones
cjones@findlay.co.uk

Publisher
Ed Tranter
etranter@findlay.co.uk

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An event designed with you in mind

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

As a regular reader of this magazine, you will be aware of the importance that *Eureka* as a magazine attaches to design engineering and design engineers.

Certain fundamental principles have always underpinned *Eureka*: namely, the desire to offer our audience practical, innovative and, above all, relevant information about the latest technologies that offers them solutions to their design issues, as well as showing them new ways to approach existing problems.

This desire has led us over the years to offer readers a range of products and services in order to ensure that they get the greatest possible value from us and that *Eureka* is always perceived as offering its audience what they want and need.

Thus, when in our 2011 Reader Survey we saw that the answer to the question 'Would you be interested in attending a design engineering focused exhibition and conference organised by Findlay Media?' was a resounding 'Yes', it meant we had to do something.

It is with this in mind that this month's issue sees the announcement of the launch by *Eureka*'s parent company Findlay Media of The Engineering Design Show. Taking place on 11-12th October 2012 at the Ricoh Arena, Coventry; this will be an event that puts the needs of design engineers first.

A report on the show appears on page 22 and futher details will of course appear over the coming months, but for the moment let me assure you that we at *Eureka* are extremely excited about the Engineering Design Show, not least because it offers us another way for us to reach and serve our readers.

We look forward to seeing you there.

Cream of the crop

Once again, the British Engineering Excellence Awards showed the depth and breadth of the UK's engineering community.

The winners of the 2011 British Engineering Excellence Awards were announced at a gala luncheon at London's Globe Theatre on 13 October.

Congratulations to all the winners and to Grand Prix winner ICS Electronics. And thanks to all the companies that entered. The BEEAs will be back again in 2012, so watch out for the call for entries next year.

1 Grand Prix 2011
Sponsor: Findlay Media
Winner: ICS Electronics

The winner of the British Engineering Excellence Grand Prix was selected by the Judges from the winners in the other categories; a challenging task, given the standard of entries to this year's Awards. But ICS Electronics met the Judge's criteria.

The competitive marine radio market features many well known companies. Yet ICS Electronics – with only 10 full time employees – has installed Digital Selective Calling (DSC) systems – one of the most important parts of the Global Maritime Distress and Safety System – in 55 countries with more than 1000 operators. Bearing in mind the nature of the company's competition, that is an impressive achievement.

DSC systems became compulsory for commercial vessels in 1999 and features in most marine radios. According to ICS, early entry to this market has secured its name and reputation.

In 2010, ICS developed a replacement DCS system for UK Coastguard and in 2011, launched its Audio Switch range, based on the Voice over Internet Protocol (VoIP) standard. Describing the approach as 'Radio over IP', ICS says this system can't be created using off the shelf components. Problems included synchronising IP packets from multiple receive sources and using a voting system, with results presented to an operator in a clear and understandable format.

2 Consultancy of the Year
Sponsor: Prototype Projects
Winner: Vocis Driveline Controls

Five companies made this year's shortlist, each a different size and operating in a different market. But there are measures that can be applied, including speed, flexibility and productivity: a good consultancy will be able to demonstrate all of these qualities.

Debate for this Award was heated, but the Judges finally selected Vocis Driveline Controls; the second year in succession that a consultancy serving the automotive market has won this category.

Formed in 2006, Vocis' customers range from global manufacturers to specialist UK suppliers. These customers access Vocis' expertise in the integration, control and calibration of automotive transmission systems, as well as a comprehensive range of transmissions for electric vehicles.

Innovation is central to the company's offering. Its technology enables customers to improve the competitiveness of its products by refining performance, boosting controllability and reducing fuel consumption.

Working with such well known names as Aston Martin, Lamborghini and McLaren, Vocis is now working with Zytek on what is believed to be the most advanced electric vehicle yet launched.

3 Small Company of the Year
Sponsor: D Young & Co LLP

Winner: ICS Electronics

Most companies in the UK's manufacturing and design sector have fewer than 20 employees. While being a small company allows you to focus sharply on your chosen market, unless you are agile, there's every chance that a large competitor could stand between you and a lucrative contract.

The Judges wanted to see a company with a sound business addressing a particular market need, an evolving product portfolio and a good reception for their products from customers.

ICS Electronics ticked all the boxes. Established in 1982, the company is a leader in its three chosen markets: coast stations; commercial; and leisure. The coast station market provides 90% of the company's revenues and 85% of its turnover comes from exports.

The company invests heavily in new product development to help it maintain its market position, while it also participates actively in promoting best practise through international committees, maritime organisations and technical forums.

Competition for the 10 strong company comes from well known names and, of the many larger companies which have tried to access the market, few remain.

4 Start Up of the Year
Sponsor: Cambridge Consultants

Winner: Neul

Entrepreneurs are always up for a challenge; particularly when there is a brand new market to exploit. But starting a company is no guarantee of success; along with solid technology, the company needs a sound business plan and, most importantly, orders.

Our winner was established in 2010 by a group of entrepreneurs with a serious track record; included are some founders of CSR.

Neul believes the unregulated white space spectrum – the communications bands vacated by television's move from analogue to digital broadcasting – will be ideal for wide area communications. It envisages the creation of a national network for M2M communication and believes 99% of homes can be covered with just 4000 sites.

In less than a year, the company has developed the first production ready white space radio and shipped devices to customers. It has also worked with a customer to install a full wide area coverage network across Cambridge and some rural areas. Neul says it just goes to show what a small, highly motivated team can do.

Highly Commended: Congratulations to Cambridge CMOS Sensors, whose entry was highly commended.

5 Design Team of the Year
Sponsor: element 14

Winner: IHC Engineering Business

Large products need teamwork. Producing a design on time and to requirements is demanding. Along the way, design decisions have to be made in order to meet a target price and there are always milestones to be met.

The Saipem J-Lay Tower is said by IHC Engineering Business to be one of the most versatile pipelaying systems. It raises a pipe section from the vessel deck to near vertical, aligns it to within a millimetre, then welds it into position. The system can work with pipes of up to 36in in diameter, with pipe lengths of up to 48m. This was a 'first time build'; there was no 'prior art' to refer to and there was a fixed deadline.

According to the design team, this was a complicated project, with several large engineering challenges. Overcoming them required disciplined team work of the highest order.

The project was delivered on time and is ready to start work.

Highly Commended: Congratulations to Pelamis Wave Power's P2 Wave Energy Converter design team, whose entry was highly commended.

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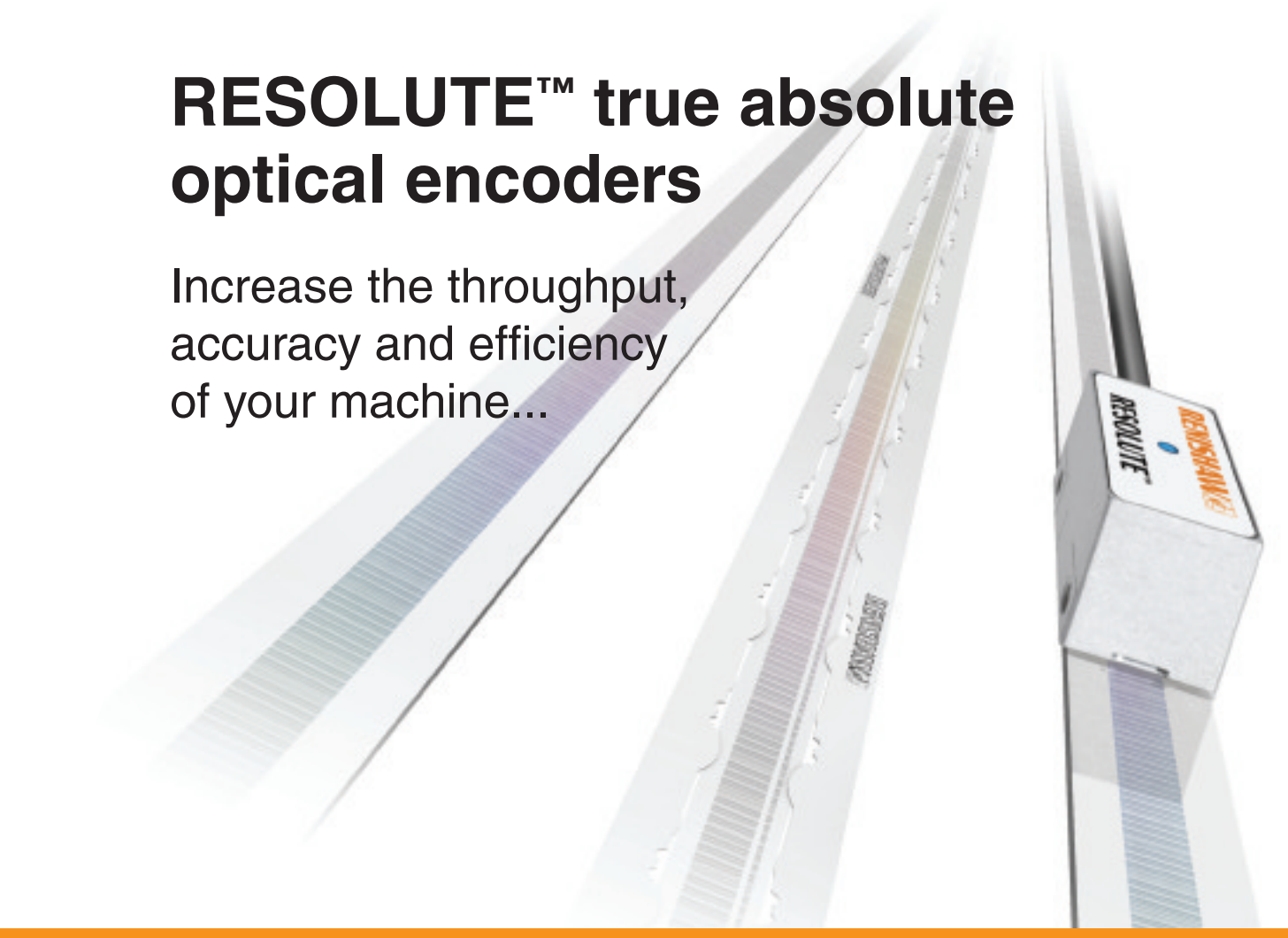

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6 Green Product of the Year
Sponsor: National Instruments

Winner: e2v ProWave

With the growing recognition that the environment needs to be protected as far as possible, green design is now right at the top of the list. If a design can save energy and reduce pollution, then it's a job well done.

In order for Vermiculite to be usable, it must be 'exfoliated' to generate desirable qualities. Until now, this has been done using oil or gas fired furnaces, requiring 1MW per tonne. While it has been known for some time that microwaves could do the job, no commercial process existed until e2v developed the ProWave system.

A first of its kind, ProWave has been purpose built for the application: from magnetic separation at the front end to a microwave transparent folding belt and the end. Using e2v's microwave technology, the energy requirement is reduced by up to 90%, yield is increased by at least 5% and there are no CO2 emissions. e2v claims ProWave is a 'truly green product'.

Highly Commended: Congratulations to Ashwoods Automotive, whose entry was highly commended.

7 Mechatronic Product of the Year
Sponsor: Eureka and New Electronics

Winner: RF Golf

Entries for this category had to describe the innovative application of electronic and mechanical technologies in order to solve a given problem. The entry which caught the Judges' eyes was the golf ball location system from RF Golf. This three person company had taken on a large task; creating a golf ball with integral electronics which met the rigorous requirements of the US Golf Association.

The electronics inside the ball are activated upon contact with the club, emitting a signal that allows it to be located to within 50cm from a distance of 50m using a hand held locator unit. Instead of spending time looking for a lost ball, RF Golf says golfers can spend more time enjoying the game.

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

Winner: Oxford Digital

The Judges experienced their usual difficulty in selecting the winner; no surprise when the entries were so varied.

This year's winning entry – Simulink-2-Tiny from Oxford Digital – produces fully optimised code directly from Simulink in seconds. According to the company, this surpasses by around 10% in program size and execution speed what an expert programmer can achieve in months.

Oxford Digital has developed from scratch TinyCore, a low power, low gate count dsp core suitable for use in audio, closed loop control systems and in sensor applications. Clients include Sony, Wolfson Microelectronics and D&M Holdings, developer of Denon and Marantz products.

Simulink-2-Tiny allows engineers who design algorithms using Simulink to eliminate the coding stage for TinyCore; the work is done automatically and the results can be used in real time within a few seconds.

9 New Mechanical Product of the Year
Sponsor: igus (UK)

Winner: Fireco

Our shortlist this year featured products ranging from a folding bicycle to a hybrid powertrain with a new rotary engine. In between these extremes lay this year's winner – Freedor, a wireless electrically powered device designed to close a fire door within 15s of an alarm sounding.

Freedor was seen to be a creative solution which has already demonstrated sales success since its launch.

Fireco spotted a gap in the market for a wireless door closer. While similar devices are available, all require hard wiring into a fire alarm panel, as well as a constant power supply.

Many buildings have fire doors held open illegally; Freedor allows these doors to be held open legally. Fireco's solution is a battery powered, self contained device featuring electro-permanent magnets. Power is saved because it is only required when releasing the door.

10 Young Design Engineer of the Year
Sponsor: RS Components

Winner: Darren Jones

To a large extent, employers want their new recruits to contribute as quickly as possible to their business, but the transition from university to the 'real world' isn't always an easy one to make. Some, however, make that jump a lot more easily than others.

Darren Jones, known to his fellow workers as 'Dazbo', was project manager for Freedor – the 2011 New Mechanical Product of the Year. He is also recognised as the sole inventor of the patented rocker assembly that allows the product to operate as a door closer.

He is now responsible for mentoring placement students employed at Fireco and, according to his employer: "His professionalism and enthusiasm have been invaluable."

Highly Commended: Congratulations to Adam James, who was highly commended by the Judges.

11 Design Engineer of the Year
Sponsor: Mouser Electronics

Winner: Shaun Addy

Engineering is about commitment. While it can be a nine to five occupation for some, those who create the best designs don't recognise the constraints of the clock. Good engineers also produce innovative designs within strict commercial limits and develop transferable technology.

Shaun Addy met many of the criteria; according to his managing director, Shaun thinks nothing of 5am starts, six days a week, to solve an engineering challenge.

His experience comes from more than 26 years of building, testing and designing high performance internal combustion engines at companies such as Lotus and BMW. His latest design, the Cubewano rotary engine, can run on kerosene – something previously believed to be impossible – providing a high power to weight ratio.

12 Judges' Special Award
Sponsor: Totally Engineering

Winner: Peratech

The Judges were keen to recognise a company that epitomised the British Engineering Excellence Awards by combining ingenious design and solid business principles to achieve success.

Peratech's latest innovation, QTC Clear, can be used to create pressure sensitive touchscreens, which it believes will be 'superior' to today's resistive and capacitive devices.

Peratech entered the BEEAs in 2010 and the Judges were impressed by the Quantum Tunnelling Composite technology. But questions were raised about its commercial viability. Those queries were answered by this year's entry, which demonstrated impressive commercial success and promises great things.

Peratech has already licensed QTC Clear to a leading touchscreen manufacturer, one of seven 'significant' agreements.

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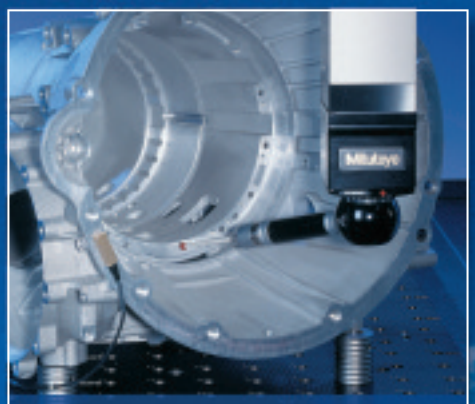

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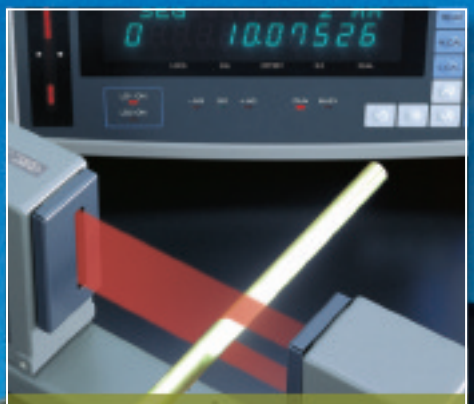

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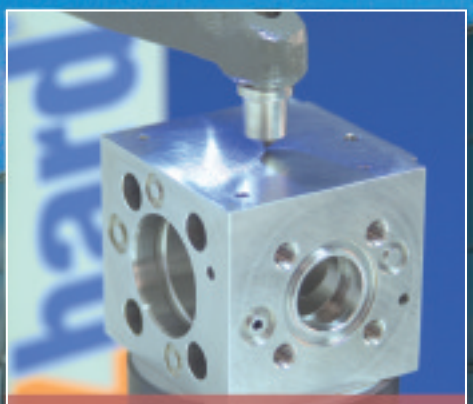

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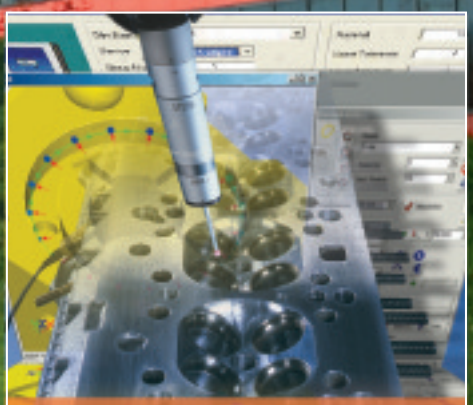

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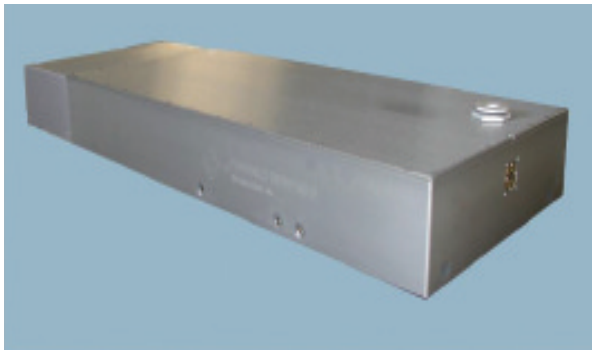


Photonics Industries has announced it is to produce a high intensity sub-nanosecond series laser for industrial micromachining applications. Using shorter pulse width lasers to enable a more precise ablative-based material processing is a continuing industry demand.

However, if the pulse width is too long, processing is fast but is carried out with less accuracy. Reducing the pulse width so it is less than 10ps for example, means processing becomes very precise, but takes much longer. In an effort to balance the optimum pulse width against material removal rate, Photonics Industries has developed a unique sub-nanosecond, less than 1ns nominal pulse width, laser. It has combined this with TEM00 mode quality (M2 <1.5).

The company has also announced a unique high intensity (high brightness) sub-nanosecond laser (the SN series) for industrial micromachining applications. These lasers can be used for next generation applications such as tempered glass, ceramics cutting, scribing and drilling, crystalline silicon or thin film based solar cell processing, LED substrates scribing and dicing and flex circuit cutting.

www.photonix.com

Minimum friction results in best sealing

A sealing solution by Leicester based Simrit for pneumatic applications uses innovative geometry to reduce the effect of friction during in use.

The Low Friction Piston Seal is a response to market demand to extend the operational life of its pneumatic drives despite growing shaft speeds and cylinder cycle rates. To get the best performance in this area, the mass and surface profiles of seals generally have had to be greatly reduced.

However, more compact seals react more sensitively to deviations in operating and production parameters. The consequence of this trade off is that the radial forces increase over proportionally and this reduces service life.

As a result, the Low Friction Piston Seal combines compact dimensions with low friction and high reliability. Innovative sealing concepts minimise the radial compression of the sealing cross-section and therefore wear.

The Low Friction Piston Seal easily achieved 1.5 million cycles in testing without showing any considerable wear. The seal also needs very little installation space. The sealing effect is independent of piston clearance and radial piston movements.

www.simrit.co.uk

Rotary stage features ceramic drive

Nanomotion's new FBR60 piezo-electric miniature rotary stage is now available from Heason Technology. Providing an exceptionally compact footprint and low profile for precision motorised rotary positioning, the stage has a 60mm diameter rotating element and overall height of just 35mm and features a high-stiffness cross roller bearing construction, twin piezo-electric motors that provide zero backlash direct-drive, and an integral non-contact optical encoder with micropositioning resolution options of 5 or 0.5 arc-seconds.

Available in standard, vacuum and UHV versions, the FBR60 has an overall accuracy of 10 arc-seconds with speeds to 360 degrees/second and direct load capacity to 5kg. A central through aperture may be used for underside cable or services entry for user devices, which are conveniently mounted on the rotating plate via a matrix of M2.5 threaded holes. The stage may be used independently or as a part of a multi-axis positioning set-up with Nanomotion's FB series linear and goniometric stages allowing nanometre level translation for all six degrees of freedom.

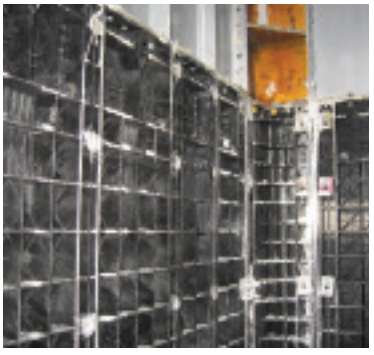
www.heason.com

Lightweight concrete uses GF composite

Material manufacturer, Sabic Innovative Plastics, has helped develop concrete that is reinforced with a glass fibre composite. The material has been developed to replace traditional steel forms. The company claim it reduces weight by 40%, cuts cycle times from three hours to just a few minutes and has helped to reduce overall construction costs. The concrete forms are used to mould concrete panels for houses.

Sabic's LNP Verton structural composite uses long glass fibre reinforcement. While providing exceptional mechanical performance, it has excellent dimensional stability, strength and resistance to humidity needed for demanding concrete work. The fabrication of traditional metal forms requires assembly of as many as 30 different components and can take up to three hours.

James LeGacy, general manager (Americas) at Sabic said: "Replacing metal forms with our LNP Verton [long glass fibre] compound material is a major step forward in building and construction because it addresses top industry demands for better materials, greater speed, lower costs and improved ease of use."



www.sabic-ip.com

Solution to last month's Coffee Time Challenge

The solution to last month's challenge of how to ensure that mobile devices can be charged without using external power sources or batteries comes from US company Tremont Electric in the form of its product the nPower PEG.

The nPower PEG is a backup battery charger for hand-held electronics that uses the energy you generate while moving. As you move, your PEG will continuously top-up its internal battery providing you with the extra power when you need it; when you're on the go.

The nPower PEG is claimed to be the world's first passive kinetic energy charger for hand-held electronics. It is essentially a vibration harvesting technology. It harvests kinetic energy from large amplitude, small frequency forces that occur in nature. Human walking, wind, and waves are good examples of these types of forces. It works by moving a magnet through a coil - which of course generates an electric current. The nPower PEG is a smart device which automatically senses your activity, adapts to it, and optimises energy harvesting.

For example, the PEG has optimum power output within a frequency range. And it also has the ability to harvest ambient vibrations that are experienced in daily life, such as riding in automobiles and trains or riding a bicycle. nPower's electrical output correlates directly to the physical size of the device.

www.npowerpeg.com

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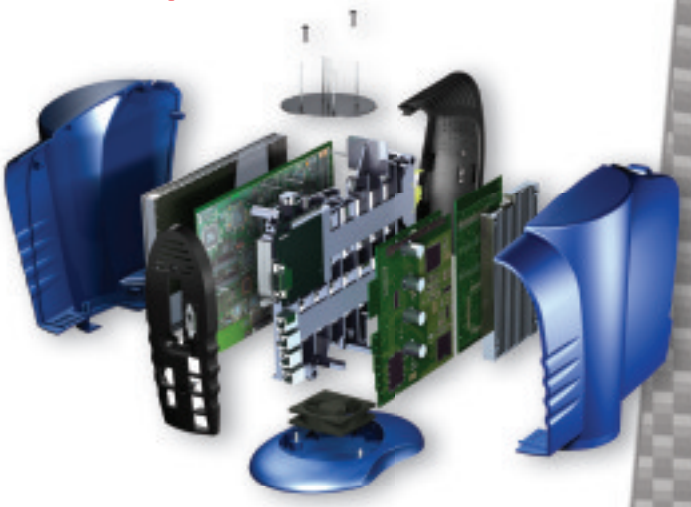

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Forward in reverse

The process of reverse engineering has a long history. It was perhaps first industrialised into an engineering process during the post-World War II era as the US frantically tried to figure out how German rocket technology worked for military advantage.

More recently, after a Red Bull Formula One racing car crashed at a recent Grand Prix, it was hoisted up to reveal its underbody diffuser. The photos taken were no doubt then studied by engineers at competing teams as they entered in to a reverse engineering process to try and figure out, how it works, how it's made and just why it gives superior performance.

As a result of these activities, reverse engineering is often associated with negative connotations and perhaps people often think of military or commercial espionage, copying of patents, copyright infringements and intellectual property theft. However, reverse engineering actually has a perfectly legitimate place in the modern design process and is a technique that is gathering pace and popularity.

"We tend to call it virtual prototyping, or digital prototyping, which is basically extracting characteristics from competitive products and using that as a basis to improve your own design," says Professor Mark Williams, deputy head of Warwick Manufacturing Group's digital theme technologies. "Obviously intellectual property rights (IPR) are in place and still there, and you most definitely can't copy things that are covered by patents. However, you can often take physical characteristics such as internal and external geometry and convert that in to working CAD models, which can improve the design process."

The premise of reverse engineering is almost like a benchmarking exercise. You are assessing the 'best-in-class' product, understanding what makes it 'best-in-class' and then trying to gain a competitive edge. This approach is widely used in the automotive industry, where companies often freely lend each other cars to facilitate it. There are generally a number of stages involved, but the first is capturing geometry,

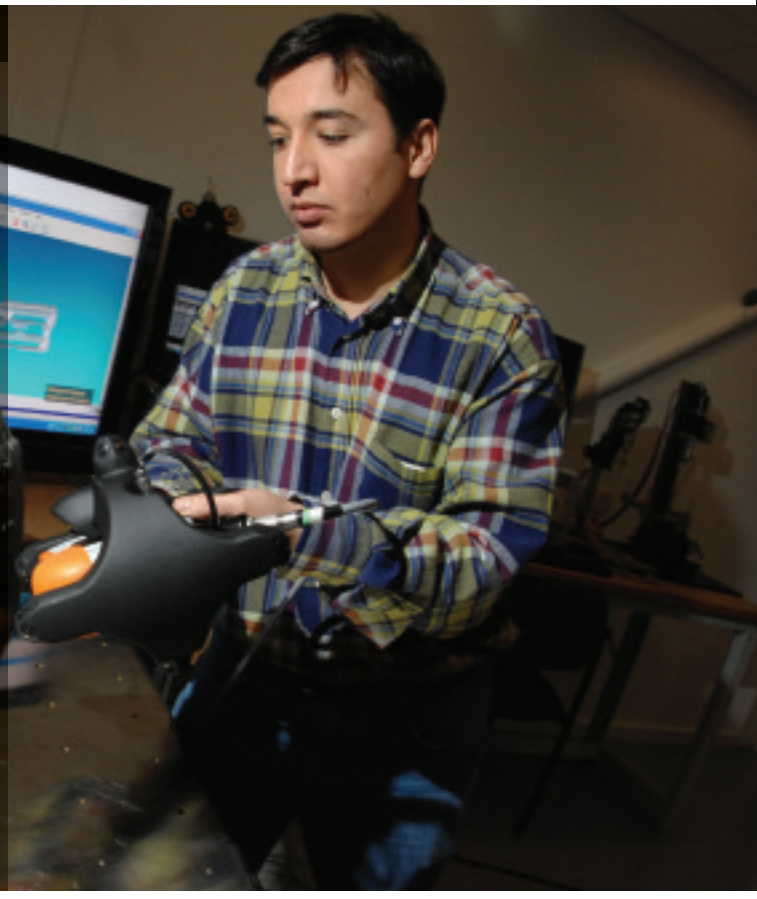
Proceed with caution

Reverse engineering can be used to benchmark your product or clearly identify why another product is better. This is often uncomfortable territory for the design engineer, but it shouldn't be, as long as rules are followed and processes are not abused.

You do have to be careful. And there is a lot of vague and untested territory here, but as long as judgement is used and intentions are good, then generally engineers can use reverse engineering processes without problems. However, the design must be moved forward, it cannot be a copy. As long as a final product does not infringe on any specific patents and is not a direct copy of the geometry of a given product, it is a perfectly acceptable and legitimate design tool.

"Using my iTunes or iVideo, if I am not paying attention I can very easily use copyright that I shouldn't be using," says Rachael Dalton-Taggart, director of marketing communications at Geomagic. "There are lots of products and technologies that have a lot of potential for illegal or inadvertent or purposeful abuse. And 3D imaging and reverse engineering obviously holds the same potential. We have found over the years that reverse engineering as a term quite often is given a negative connotation because of this potential, but it shouldn't have.

"Companies and the IP owners can protect themselves. First by education about the law, and second by enforcement of the law. If people think that all people are going to use it for is steal our IP, then that is absolutely not the case. There is always going to be people that are going to use products and technologies, for illegal reasons. Through education and developing tools to help secure these things, it will help guide people to make the right decisions."



Reverse engineering is a valuable and respectable method of advancing design. Justin Cunningham finds out how it works.

Laser scanning a surface (above) to produce a point cloud and then a surface model (below right) to enable simulations and then parametric models to be produced. These can then be edited and manipulated to improve upon the design (below)

which can be achieved using a variety of techniques and technologies, from touch probe coordinate measuring machines (CMM) to laser scanning, photogrammetry and CT scans.

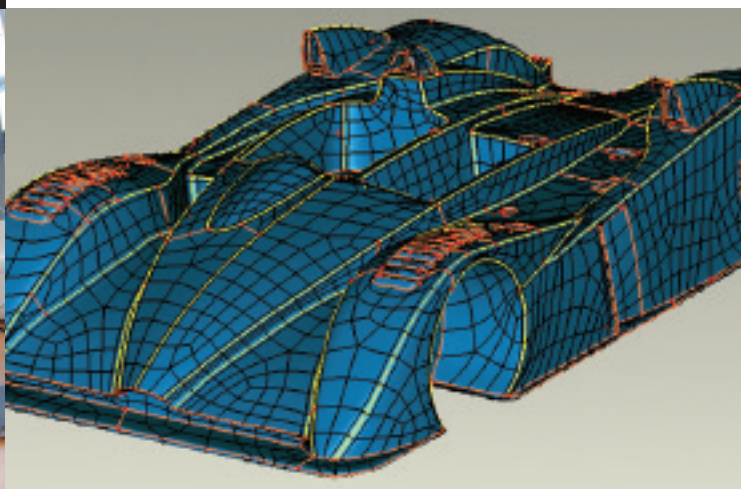
Scanning a component or part produces what is known as a point cloud. These are essentially millions of individual points in space that define the geometry of the part that has been scanned. However, to go from a point cloud to a workable CAD model that can be manipulated, edited, and added to, takes a lot of time and effort.

Post processing of point cloud data is a highly skilled, time-consuming and laborious task which is generally why it has been outsourced to experts, who go through the points and remove the 'noise', missed and duplicated points, of which there are literally millions.

"Once you have a clean working cloud, you can then create a .stl, surface file," says Professor Williams. "You triangulate all these individual points to get a surface. But, you can't really use that for anything – it is just a load of tessellated triangles in space. The really clever part is actually cleaning that surface file to get it in to a workable format where you can actually use it in whatever application you want."

To get a simulation model from a clean surface file is more straightforward, as the tessellated surface model is very closely related to that of a finite element mesh. However, the difficulty comes when the production of a full parametric CAD model is required.

"Rather than starting from a blank sheet of paper, you have got a parametric model based on something that works in the market place," says Professor Williams. "This process saves so much time and can then be used as a basis for moving a design forward and improving upon it."



This is not, however, something that requires high investment and a tool only available to multinational OEMs with large design budgets. Like most things in life you get what you pay for, and this is reflected in the accuracy of the scans that will be produced. But, portable and cost effective solutions are available and can quickly and easily produce a point cloud of a component.

Geomagic's specialises in providing reverse engineering and 3D inspection products to industry and supports this with professional services and consultants. They have seen the industry grow tremendously in recent years as the cost of scanning technology and computer processing power has reduced.

It has seen steady progress over the last 10 years in point cloud processing and reverse engineering software, aided by two recent breakthroughs. First has been the ability to capture and reproduce what it refers to as 'design intent' of a physical object.

Design intent modelling extends reverse engineering from simply producing an accurate digital copy of a scan by automatically identifying primitive shapes, swept features and freeform surfaces. This ability to generate CAD ready surfaces from scans of physical objects has laid the groundwork for another significant development; a technology dubbed by Geomagic as 'Parametric Exchange'.

Parametric Exchange is essentially a software bridge from the point cloud to a CAD model. It enables the automatic reconstruction of geometry such as parametric surfaces, data and curves without the need for intermediate neutral files such as IGES or STEP.

Geomagic's Rachael Dalton-Taggart says: "Imagine you want to design a bike handle grip or something similar. It would make sense to scan in an existing one – of course making sure you are not infringing on someone else's IP – and use that as a basis for a design; a starting point. Why start from scratch and try to reinvent the wheel when there is something there already? Being able to very quickly turn a physical part in to a 3D model gives you such a head start in product design."

This closed loop between scan data and CAD models gives product designers and engineers the freedom to explore endless variations of products. It also has the potential to save in tooling costs. For example, instead of recreating an expensive mould from scratch, companies can scan an existing one, analyse the wear and tear, design an improved model, and manufacture new moulds in days instead of weeks or months.

Such a system is also useful for capturing design geometry such as natural shapes. For example, a new hand grip for a bike could either be designed towards a specific demographic – younger children for example – or indeed to custom fit a specific person. And this has great potential for medical applications.

Dalton-Taggart says: "Prosthetic limbs at the moment are generally generic devices that are not going to fit everyone with equal comfort. To be able to do a scan of an existing joint and very quickly produce something customised would be a tremendously powerful tool.

"Custom mass manufacturing is definitely out there on the horizon, and it is because of these technologies. At some point we will be sending a scan of our feet to shoe manufacturers so the shoes are custom fit."

The ability to capture an existing design and quickly adapt it to new styles and purposes is critical in the evolution from mass manufacturing to mass customisation. These tools will go some way to delivering on the promise of individualised design on an affordable, mass scale, basis.

The process also finds a lot of use where rare or one off parts need to be recreated. Work at WMG has seen the technology used by archaeologists to reverse engineer rare artefacts, and also with the British School of Rome for a rare statue head.

But more industrialised uses of this same concept are being applied to firms that have lost CAD data, designs or drawings, or which have inherited tooling from buyouts or takeovers. Old parts which have failed or need replacing can be scanned and this can then be used to see where the wear is on the surface, for example. Essentially this allows digital inspection of old parts to be assessed for wear and tear in some detail. Through that, finite element analysis can be run, and then it is possible to re-engineer the part to improve it.

Reverse engineering has numerous uses and roles to play in the design and engineering process, from taking a best in class product and using it as a baseline for product development, to saving time modelling what is essentially standard geometry. Of course, good judgment is essential when analysing and assessing competitor products, but it is a tremendously powerful tool that is definitely moving design forward.

www2.warwick.ac.uk/fac/sci/wmg
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The automotive industry is constantly finding ways of reducing CO_2 emissions, and developing more energy efficient vehicles. One is the stop-start functionality, where the engine automatically stops at traffic lights, queues or stop signs and is instantly re-started at green light.

SKF engineer Susanne Blokland and her SKF team have made a key contribution to this technology; the SKF Rotor Positioning Bearing. A magnetic field from this bearing provides the engine control system with the rotor's exact angular position, thus enabling the engine to be conveniently re-started. The bottom line is significantly reduced CO_2 emissions. Up to 30 percent in heavy city traffic. And fuel consumption may be cut proportionally.

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Susanne Blokland, SKF

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Rapid manufacturing gathers pace

Why has additive layer manufacturing not progressed as fast as once hoped? Paul Fanning asks one of its UK pioneers.

When the first stereolithography machines reached these shores in the early 90s, there were confident predictions that layer manufacturing was the technology of the future. Nearly 20 years later, it is apparent that progress was destined not to be as meteoric as was once hoped. Nonetheless, it now occupies an established place in design and manufacturing.

Graham Bennett, technical director of layer manufacturing specialist CRDM was one of the pioneers of this technology in the UK, having started with a rented stereolithography machine at what is now Buckinghamshire New University at a time when, as he puts it "there were only about nine other machines in the country".

Talking about the progress of the technology, Bennett says: "It's not where most of the industry expected it to be. At the start, you had the early adopters taking the technology on board and that inevitably meant a lot of machine sales. This meant that companies expected the machines to migrate naturally into the production environment. But they didn't really take into account how big the gap is between having a prototype made and having a production part made."

This gap is one that CRDM has spent many of the intervening years between its inception and today filling. Having now spun out from the University in 2007 and moved to its current premises in High Wycombe, the company has a range of layer manufacturing machines, as well as offering more traditional machining and injection moulding services – even acting as an agent selling Hewlett Packard's 3D printers.

Nonetheless, layer manufacturing is still close to Bennett's heart and its progress from a pure prototyping tool to a player in the manufacturing environment is one he is keen to foster. However, he recognises a range of problems that are still preventing this from happening. He says: "The problem is not that the technology cannot achieve what is required for production parts in certain circumstances, it's that the expectations of the customer need to be changed. That's almost a bigger problem because it takes in things like quality standards for inspection requirements. For instance, the finish will be different on an additive layer manufacturing machine to what you'll get on a moulded part – not better, just different. But overcoming that inertia of people's expectations and culture can be hard to overcome."

This 'inertia' preventing adoption of the technology takes a number of forms, Bennett believes, one of which is the fear of risk inherent to many big companies. "It required too many people to go out on a limb in big corporations – the 'nobody ever got sacked for buying IBM' mentality kicked in. But in smaller and medium-sized enterprises, where there was more flexibility, they've been able to adopt it."

Another major factor, of course, is the number of industries in which the importance of recognised quality standards create a barrier to the adoption of the technology for manufacturing purposes. Says Bennett: "There are no recognised quality standards for layer manufactured parts to go into flight components on aircraft. People are writing them, but as things stand, if you send a metal part into an aircraft manufacturer, the first thing they'll do is look up which quality standard he should apply to test the part and if there isn't anything written, the process pretty much stops there."

However, he does believe things are changing, albeit slowly. He says: "It's improving as younger engineers come into the industry. Whereas it was once brand new technology, now you're getting people who were born after the first SLA machines were installed coming into the industry. When they come through from University into design departments, they aren't stuck in the same ruts."

"There have been many false dawns and over-promises about the capability of the technology"

While he does not believe layer manufacturing will ever replace all other processes, Bennett does believe it is already finding niches as a manufacturing technology that will allow it to get "its foot in the door", pointing in particular to the way in which certain automotive companies are using ALM parts in top-of-the-range vehicles because it means not having to buy – and then amortise – the tooling for what may be only a few hundred parts.

Summarising, Bennett says: "There have been so many false dawns and over-promises in terms of the capability of the technology, but I think it's inevitable that it will become mainstream in production, though. People say to me: 'It's been 20 years!' and I have to point out that 20 years isn't really that long in this context."

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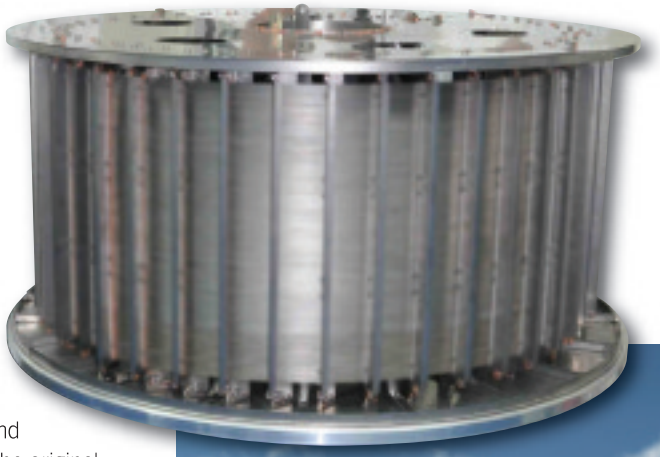
High-density heat exchanger developed for aerospace

Tom Shelley reports on the development of what is believed to be the world's highest performance heat exchanger.

With a thermal density of 1GW/m^3, the heat exchangers for the engines of the 'Skylon' hypersonic space plane will cool the engine airflow from intake recovered conditions of up to 1000°C to -140°C in just 0.01s, in order that it can be compressed again when the engines run in jet mode, without raising temperatures so high that they melt everything.

Despite the extreme performance, the first full sized unit, built for testing, is made from quite ordinary, commercially available materials, even though it presses the limits of manufacturing techniques.

According to Mark Hempsell, the Future programmes director of Reaction Engines, which is the company behind the project, the heat exchanger is made up of banks of 20µm thick, 1mm diameter Inconel tubes, brazed together in a 'Swiss Roll' configuration to perform as a cross flow, counter current design. The cooling fluid is helium, which when heated is used to drive the turbo compressor to deliver air to the rocket engines which will power the machine in jet mode.



The project is descended from the HOTOL – HOrizontal Take Off and Landing design, which conceived the original idea of a hydrogen powered aircraft whose engines would function as jets on take off from a conventional runway, and rockets when the craft reached to top of the atmosphere. The new concept is based on the old one, except that new inventions have been made in order to get round the original patents, which were sold to Rolls-Royce, and the new machine is to be made entirely of commercially available materials instead of exotics.

Reaction Engines has got much further than the original HOTOL project, largely because it has benefitted from two tranches of €1 million funding from the European Space Agency, backed by the UK government, which has enabled a further £6 million public/private financed development programme. The primary purpose of the development is to reduce the cost of launching satellites, which is currently around $10,000/kg even after around 50% subsidies. The design is intended to reach Mach 5.5 in air breathing mode and then go into rocket mode at an altitude of 25km. For launching geostationary satellites, there is to be a second rocket stage launched from the payload bay, which will return to earth and, once recovered, will be able to be reused.

Because the machine is to be powered by hydrogen, which is much less dense than conventional jet fuel, most of the interior of the craft will be hydrogen tanks, which are to be made of aluminium lithium alloy. The exterior of the machine will be covered in glass ceramic panels, with 1mm expansion joints between them. This means that they cannot contribute to the overall structural strength of the machine, so the airframe is to be based on silicon carbide reinforced titanium, metal matrix composite, girder trusses. This is inspired by 20th century, rigid airship design, which had hydrogen tanks suspended within an aluminium girder structure, with a fabric covering. However, unlike the old airships, there is a to be a very clever, titanium foil-based insulation system that will protect the trusses and the panel clips from the hot panels.

At time of writing, the engine technology development programme is to be completed by the end of 2011. Two test vehicles are to be constructed in 2016, with production prototypes to be tested in 2018, and commercial operations to commence in 2020.

www.reactionengines.co.uk

Engineering design show

10th -11th October 2012 · Jaguar Exhibition Hall · Ricoh Arena · Coventry

In October 2012, *Eureka*'s parent company Findlay Media will open the doors of the inaugural Engineering Design Show. Here, *Paul Fanning* offers a preview of this exciting new event.

Better **by Design**

The UK currently employs 106,722 design engineers at 12,981 sites in the mechanical, electromechanical and electronics disciplines across the full range of industry sectors. And yet there is currently no standalone exhibition or industry event that meets their requirement for information, advice and – above all – innovation.

At a time when it has never been more important for design engineers to have access to the latest information, advice and technological developments, it seems particularly strange that there is no event tailored specifically to their needs. The increasing imperative for engineers to operate across a variety of technological sectors and incorporate ever more advanced technology into their designs makes the importance of getting to grips with the latest products and techniques crucial.

At the same time, of course, ever-greater constraints on the time available to engineers have made it increasingly difficult to attend exhibitions as a whole. And, if those exhibitions focus purely on one technology or market sector, justifying that time can be even more difficult. As time becomes more precious to the individual designer, so the need for a single show that runs the technological gamut under one roof would appear to have become more pressing.

This was borne out by research undertaken by *Eureka* and *New Electronics* Magazines in July 2011. A significant sample of the two magazines' audiences was surveyed to identify the potential for an engineering design-focused event. Of 600 interviews carried out, 75% of *Eureka* readers and 68% of *New Electronics* readers said they would be interested in attending a design engineering-focused exhibition and conference.

Armed with this information, *Eureka*'s parent company Findlay Media has therefore decided to fill this longstanding gap; announcing the launch of The Engineering Design Show, which will take place on 10th & 11th October 2012 at the Jaguar Exhibition Hall, Ricoh Arena, Coventry and for which Schaeffler UK will act as headline sponsor. The show will feature a high-level conference, 24 practical and informative workshops and will feature the brightest and the best in UK engineering.

Findlay's stable of magazines, including *Eureka*, *New Electronics* and

"The show will feature a high-level conference, 24 practical and informative workshops and will feature the brightest and the best in UK engineering."

Automotive Design, demonstrate the company's commitment to excellence in engineering design and credibility in the sector. Bringing this knowledge to bear in the form of a comprehensive trade exhibition seems like the next logical step.

Speaking about the launch, Findlay Media's Executive Director Ed Tranter said: "The research simply confirmed for us that The Engineering Design Show will offer something unique and valued in the market: an exhibition catering specifically for design engineers, regardless of the industry in which they work."

The *Eureka* and *New Electronics* reader surveys indicated that content addressing specific topics at the event is important. The Engineering Design Show will feature two workshop theatres and a conference area covering up to 36 sessions across the two days, with content guided by the reader survey results and further research being undertaken.

Each workshop theatre will offer visitors practical and hands-on content in the form of case study presentations by leading technology experts. This area will be free for visitors to attend and each workshop session is to be promoted individually, with a full synopsis of the content and what visitors can expect to learn. The conference theatre will carry a small delegate fee and tickets will need to be purchased in advance. The conference area and seminar theatres are deliberately located within the exhibition hall to maximise the benefit to exhibitors.

Clearly, there is no shortage of subjects to be covered at the conference, which will include topics of direct relevance to the modern design engineer and will be led by experts in their technological fields. The topics chosen will again reflect information provided in *Eureka*'s 2011 survey, which highlighted a number of areas of interest. These included such issues as: Protecting IP; Energy Efficiency; Legislation; Advanced Manufacturing Techniques; Design for Manufacture; Sustainable Design; Design Collaboration; Mechatronics; Automation; and Design for Aerospace, Automotive; Military and Medical Applications. More details of the conference and workshop sessions will be forthcoming over the coming months.

Conference topics will include:

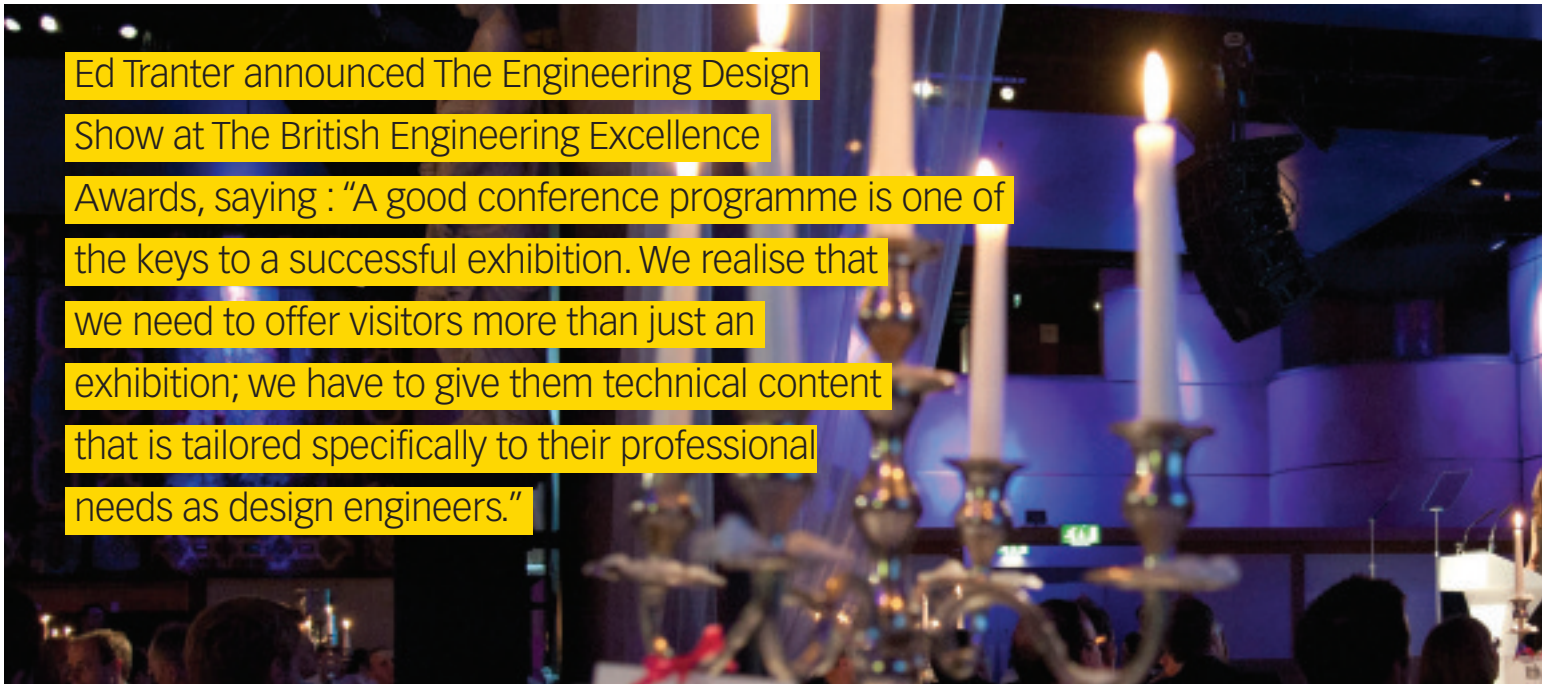
Protecting IP; Energy Efficiency; Legislation; Advanced Manufacturing Techniques; Design for Manufacture; Sustainable Design; Design Collaboration; Mechatronics; Automation; and Design for Aerospace, Automotive; Military and Medical Applications.

Says Ed Tranter: "A good conference programme is one of the keys to a successful exhibition. We realise that we need to offer visitors more than just an exhibition; we have to give them technical content that is tailored specifically to their professional needs as design engineers."

Design Engineers surveyed also stated overwhelmingly that event location and the addressing of specific topics were the most important elements to a successful show. Drive-times have been carefully considered for the location in Coventry and the topics requested will be thoroughly covered in the conference and workshops.

Jaguar Exhibition Hall at the Ricoh Arena is based within a two hour drive for 75% of the population of England. It is yards from junction three of the M6 and is near an international airport and major railway stations. Its location and its 15,000sq m purpose-built conference and exhibition centre makes it an ideal venue for the new event.

Ultimately, however, the Engineering Design Show will stand or fall by the quality of its exhibitors (a selection of whose comments can be found on the following pages) and, of course, its visitors. And, by offering a showcase for leading names in the field such as Schaeffler, Henkel and igus – as well as offering a comprehensive conference programme and technical workshops – The Engineering Design Show promises to deliver an event that design engineers can truly call their own.



What the market says ...

A number of leading companies and industry bodies have already responded positively to Engineering Design Show – and many have already signed up to exhibit. Here is what some of them have to say about the exhibition.

Steven Tetlow

Chief Executive
Institution of Mechanical Engineers

"Good design goes hand in hand with good engineering – one cannot exist without the other. The Engineering Design Show is to be applauded for offering our world class design engineers the chance to enhance their knowledge and expertise.

This conference will give design engineers a unique opportunity to meet, get hands-on training in the latest techniques and share ideas, which can only be a good thing for the industry as a whole."

Karen Preston

Marketing Services Manager
Schaeffler (UK) Ltd

"Schaeffler is looking forward to being a headline sponsor of the Engineering Design show next October. We are delighted that Findlay Media has recognised the importance of the engineering design function to the future of UK manufacturing with a targeted showcase for innovation and engineering excellence. The Schaeffler Group – including its super precision division, The Barden Corporation – has always been committed to working closely with design engineers in all industrial sectors to help them to meet their specific application requirements.

This show will give engineering designers the opportunity to meet experienced engineers from both Schaeffler UK and Barden on one spacious, purpose-built stand.

Visitors can come along and meet the team to see how they can take full advantage of value-added, cost-effective and energy efficient solutions in their particular area of expertise.

We are anticipating an exciting event in an ideal location. "

Paul Marshall

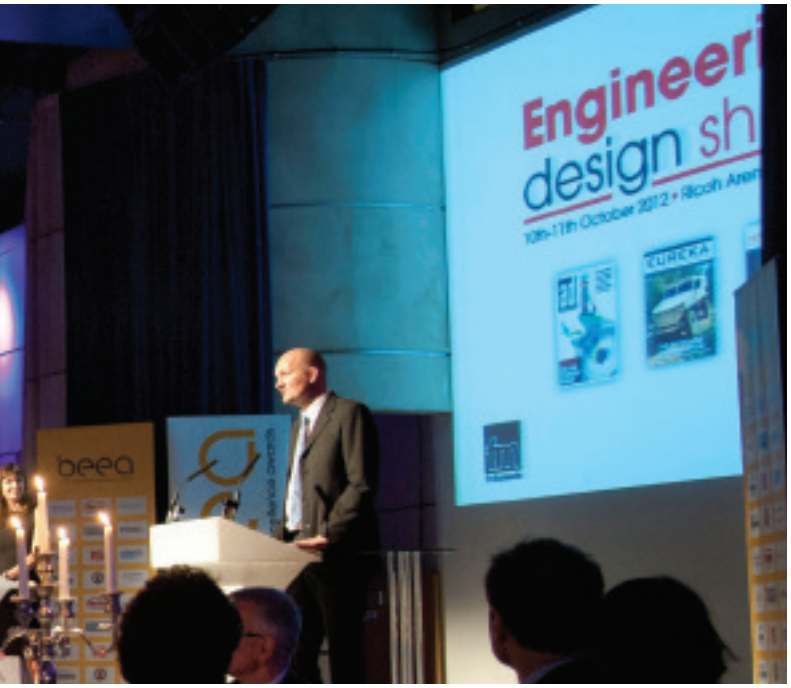
Marketing Director,
Henkel Technologies

"To have this opportunity to discuss new innovations and provide options for improved design processes across a multitude of industries is very appealing. Equally, with the pressure on designers' time, the fact they will have put aside time to explore new options when they attend the show, creates a great starting point for exploring potential opportunities. Henkel has been involved in the design process and technical consultancy for many years and expects the show to deliver a positive forum for both the exhibitor and visitor."

Matthew Aldridge

Bearings Product Director
igus UK Ltd

"igus UK is pleased to support the launch of the Engineering Design Show as we feel there is a demand for a high quality event that allows engineers



to get hands-on with products and talk to suppliers, like us, about potential solutions and new developments in technology. We envisage demonstrating a large range of our plastic bearing and cable chain products and look forward to helping people find alternatives to traditional methods that they may be using. We feel that Findlay, through its history of publishing *Eureka* magazine, has the credibility to develop this event into being a must-attend for the design engineering community. We are looking forward to it already!"

Stewart Goulding

Sales and Marketing Director,
EMS Ltd

"The customer base for our products and services is very diverse and covers everything from aerospace, defence and medical devices through to optical equipment and factory automation, so we need to be visible to the broadest possible audience. We feel that a comprehensive, all-encompassing exhibition like the Engineering Design Show offers us that opportunity."

Mark Gradwell

Marketing Communications
Manager, National Instruments UK & Ireland

"The UK has long suffered from a lack of viable, thriving live events and exhibitions for engineers, where they can learn about new technologies and techniques, get up close and hands on with the latest tools, hear about the amazing work their peers are doing, and interact with suppliers, customers and colleagues in an efficient, productive environment.

National Instruments recognises the value of such events and is pleased to see Findlay Media, via its respected engineering publications *Eureka* and *New Electronics*, address this audience with its Engineering Design Show. A healthy show for industrial design engineers is something NI and many other engineering companies would welcome, both from an exhibitor and delegate perspective."

Geoff Wilby

General Manager
TDK-Lambda UK

"We believe the Engineering Design Show is an opportunity to meet with design engineers and to discuss with them the problems they face when deciding which is the correct power architecture for their system. Because each application has its unique requirements – such as cooling, size constraints and power needs – we will have our team of experienced application engineers on hand. These engineers have an in depth appreciation of the best practice techniques to use when designing a system power solution. These solutions will optimise the power architecture and efficiency of the end product, helping it to meet the relevant legislation requirements for the world markets."

Martin Partridge

Managing Director
Brownell

"An exhibition such as The Engineering Design Show is an ideal opportunity to broaden our coverage of this market by bringing us closer to the engineers who specify products and thereby bringing us new customers and leads and allowing us to introduce our technology to new markets."

Mechatronics - The

Achieving genuinely successful multidisciplinary or mechatronic engineering design is a test that daunts many companies. However, while the complexities of such projects and the difficulties involved in co-ordinating the various technologies and individuals to a successful end result may be extremely challenging, the overlap between mechanical and electronic design is becoming increasingly common in many parts of industry.

This is something that Dr Frances Metcalfe, Associate Director, Industrial and Scientific Products at Cambridge Consultants, confirms, saying: "We're dealing with mechatronic applications across the range of industry now. Of course, there are areas that are leading the way, such as in the dispensing of fluids for market sectors ranging from consumer areas dispensing beverages through to medical diagnostic applications and drug delivery. But it's really taking off across the board."

Mechatronic design is a challenge that Cambridge Consultants is ideally placed to meet. This is due in part to the company's long-established and world-renowned expertise in all the relevant fields, but also to its experience of multi-disciplinary design and the systems it has in place to ensure success. "Although people often seek us out because we have world-class skills and capabilities in very specific areas, such as sensor development or wireless communications, optics, fluid control," says Dr Metcalfe, "they work with us in the end because we have those key systems engineering skills and know-how to apply a multi-disciplinary approach and team to product development. That's what delivers success ultimately."

Mechatronic design is a big challenge that leading engineering consultancy Cambridge Consultants is well-placed to meet.

The Prism 200 Through Wall Radar won a Queen's Award for International Trade in 2011

One of the keys to successful multi-disciplinary design, Dr Metcalfe believes, is communication. She says: "We invest heavily in terms of time and money in the systems that we have to ensure that communication is as easy as it can be because we realise how crucial that communication is to successful designs."

Good communication is particularly critical in mechatronic design because of the need to ensure the successful interface between the different technology areas. Under these circumstances, good systems engineering disciplines are absolutely critical because the mechanics, electronics and software designs often proceed in parallel. Thus, understanding the interfaces between those disciplines and how to partition the requirements and communicate them amongst the different disciplines is vital in terms of time to market because without them, the design team can end up running late and wasting money.

Says Dr Metcalfe: "It's quite often the interface definitions and specifications that are the most crucial ones that allow you to progress a design in a parallel fashion. Because as long as the interfaces between the disciplines are being defined and kept up to date, that enables the designs of the different modules to progress in parallel."

Offering an example of the the systematic approach to mechatronic design adopted by Cambridge Consultants, Dr Metcalfe says: "One area in which we do a lot of work is high-performance sensing systems, that often have to

Good communication is particularly critical in mechatronic design because of the need to ensure the successful interface between the different technology areas

best of both worlds

Developed by Cambridge Consultants, 'the world's smartest iron' from Laurastar contains a number of elements of mechatronic design

work in very challenging environments. So you can have a sensor design where you have some electronic components generating a lot of heat, others that have to be very carefully thermally controlled and kept at a constant temperature and all of those can be in close proximity and the device as a whole can have a huge range of operating temperatures. So it takes a systems approach to decide where to place components so that the sensor functions, but can also continue to operate with the demanding performance requirements and not break or melt or not work because components are not being thermally controlled. That's where the electronic designers, who are thinking about the sensors, and mechanical engineers, worrying about airflows and how you're going to get the heat out of the box, all need to work very closely to arrive at a cost-effective solution."

While this emphasis on systems may not appear to be the most exciting aspect of mechatronic design, it is crucial, according to Dr Metcalfe. "If you have a good systems engineering approach," she says, "you will tend to come up with more elegant solutions and more innovative products. Good systems engineering may sound quite bland, but actually, it's what differentiates an adequate solution from a breakthrough product.

A successful approach

Cambridge Consultants certainly has the track record to show that its approach to multidisciplinary design works. Successful examples include the groundbreaking Prism 200 Through Wall Radar, which won a Queen's Award for International Trade in 2011. While the core of the product was clearly the electronics that allowed it to evaluate room occupancy through brick walls, there was also a clear need to incorporate a number of key mechanical factors into the design.

"The electronic design is obviously crucial," says Dr Metcalfe, "But it isn't the only thing that makes it a great product. The appreciation of the human factors involved is key to its success. For instance, there are elements such as enabling the system to be used one-handed, in daytime or night time, or the need to operate the controls while using gloves. Equally, the mechanics of the design have to be taken into account, such as the housing so that it's weatherproof and the mounting of the electronics inside so that, if it's thrown into the back of a van, it'll still work later on."

So does the Prism 200 represent the norm in mechatronic design in the sense of being based around a core electronic function that has to incorporate mechanical factors? Not necessarily, according to Dr Metcalfe, who highlights Cambridge Consultants' Suma technology, which translates the three-dimensional deformation of a squeezed object into a software-readable form, allowing Suma-based devices to capture far more of the degrees of freedom of the hand than can conventional controller technologies, without the need for cumbersome gloves or sensors. Here, she points out, the design began from the mechanical point of view because the principle of the project was turning the movement of the fingers of the hand into a control signal.

Of course, without the right skills available, none of this would have been possible and Cambridge Consultants is certainly not short of highly skilled technologists (although they are always on the look out for more!). However, there is more to the company's success in the multidisciplinary field than that, according to Dr Metcalfe. "It takes world-class skills to be able to work in a multi-disciplinary team that can deliver innovative products," she says. "We're lucky at Cambridge Consultants because, although a lot of our people are world-class in their particular disciplines, they also have a natural curiosity about all the other disciplines, which really helps."

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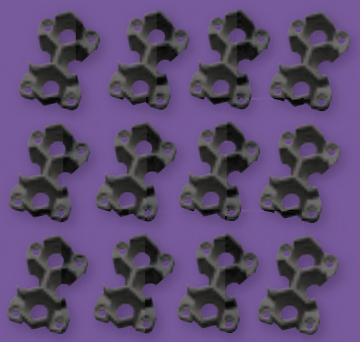

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Early prototyping benefits Bentley

Making the most of rapid prototyping technology early in the design process is bringing significant benefits to luxury car manufacturer Bentley Motors. Justin Cunningham reports.

Bentley Motors has a reputation for excellence when it comes to the design and engineering of luxury cars. So it is probably no surprise that it has been making use of rapid prototyping technology from the early days. It found that Laminated Object Manufacturing (LOM) allowed the production of under-bonnet parts that could actually be used for de-mist and air-conduit testing. The result was that the overall testing programme came in early and under budget.

The revelation meant that it wanted to expand its in-house RP capability, and made concerted effort to use the technology as early as possible in the procurement process.

RP, for many firms, is an activity that can often happen at the end of the design process; to prototype. The physical representation is often used to proof a design before it becomes productionised for manufacture. However, Bentley, has found enormous benefit in bringing the process forward, and using rapid prototyping technology for much earlier design work.

David Hayward, operations and projects manager of the design studio at Bentley Motors, says: "We would have started the design process with a sketch and then worked through to a physical model at the end of the process. But that process has changed dramatically. Now, our rapid prototyping starts at the front end, as soon as we move from 2D into 3D."

The physical representations, albeit to scale, are critiqued and reviewed like never before in what Hayward describes as desktop reviews. As well as making use of things such as the 'Power Walls', wall-sized 3D projections of CAD models, the ability to hold a physical model, and compare physical scale models with competitors' cars is proving invaluable.

Until about 2010, most of the parts that were produced through rapid prototyping were outsourced to specialist firms. However, due to the increasing spend on rapid prototyping from around £75,000 to approximately £500,000, Hayward and his team wanted to bring that expertise in house. As a result it purchased an Objet Alaris printer specifically for the design studio.

"After we had the Alaris about a year, we thought we needed to do more with it," says Hayward. Using an optical scanning system from German-based GOM, the company would very accurately scan competitor vehicles, and then reproduce them as 1/10th scale models, for comparisons with its own conceptual designs.

He adds: "We were doing 1/3rd scale models later in process in clay, but what we now have is the ability to do 1/10th scale models that we use as desktop reviews."

Clay modelling has always played a big part in Bentley's design and production process, and continues to do so. However, rapid prototyping has significantly increased and RP parts are being used on both the interior and exterior of clay models to be more representative of how the product might finally look.

During the early design phase of what became known as the Bentley Mulsanne, the

Bentley uses rapid prototyping early in the design process and in conjunction with full scale clay models

company used rapid prototyping on both the front and rear lamps of a clay scale model and also the wheels. Before this clay moulds were used. "Rapid prototyping tools give a much better and more representative look and to what the car will actually be like when we go in to a design review," says Hayward.

To further its capability the company has also recently brought an Objet Connex500 to enable the rapid prototyping of softer parts. "The whole purpose of us buying the Connex was the rubber side of it," says Hayward. "It means the design studio can start looking at the door seals and moulding those on the Connex machine to put on cars and scale models. This enables us to do things like water and moister tests and wind ingress tests. So we can start doing very early upfront testing and actually build that into the design process.

"We can also use it to make 1/10th and 1/3rd scale rubber tyres so the scale models can be much more representative in terms of what they will look like. The possibilities are endless in terms of the mixture of hard and soft materials."

Once the external themes have been finalised, the process then moves up to full scale representation. This might involve a full scale clay model of the exterior, but is increasingly involving the interior as well. This gives the distinct advantage of allowing the design teamto give early consideration to the ergonomics of the vehicle, long before its engineering and production departments have chance to get hold of the design.

"That gives people the opportunity to sit in the car and get a feel of what it is going to be like three to four months in to a program," says Hayward. "Already we are starting to look at the ergonomics and are using real parts."

About six months in to a project there is another design review. Although the same clay models are used, they are much more representative. To aid in this, 3D printing technology is used extensively to replace clay parts. The models also have a real painted finish so they give a very accurate depiction of what the final car design might look like on the road.

This is the same for the interior as well. More rapid prototyping is done; the seats recline, the rear consoles have air compact seats and although it is not functional to the full extent, it does give a good portrayal of the layout, which can be used by the designers.

Overall, RP enables engineers to be analytical and evaluative of the ergonomics, general layout and 'feel' so they can make changes. Although the changes might be subtle, these iterative improvements have perhaps in the past been the sort of thing you might see on MKII production models. But, the physicality of it all, makes the design improvements much more obvious when compared to a 3D CAD model. Having it there, in front of you, enables these subtle but important design steps to be taken earlier. And that is exactly what you would expect from a premium brand like Bentley.

"After 18-24 months that was usually the final stage for us," says Hayward. "Engineering came in, the design would be signed off and it would go forward to that team to look at the feasibility of the parts that we had designed. However, we are now able to go a phase further and actually produce a track vehicle.

"This has got a rollable chassis, is engine based, and although it doesn't do the 200mph that the production car will, it gives the board a representation of what this car is going to look like on the road."

To make the rolling chassis as representative as possible, the door handles, the door mirrors and exterior chrome, are all made from 3D-printed models. And many of these parts are fully-functional representations of how the production part is actually going to look and function.

"So many of the parts are made through RP processes," says Hayward. "And they actually function; the indicators and the headlamps work. Whereas before many of these parts were only ever moulded in clay on a static vehicle."

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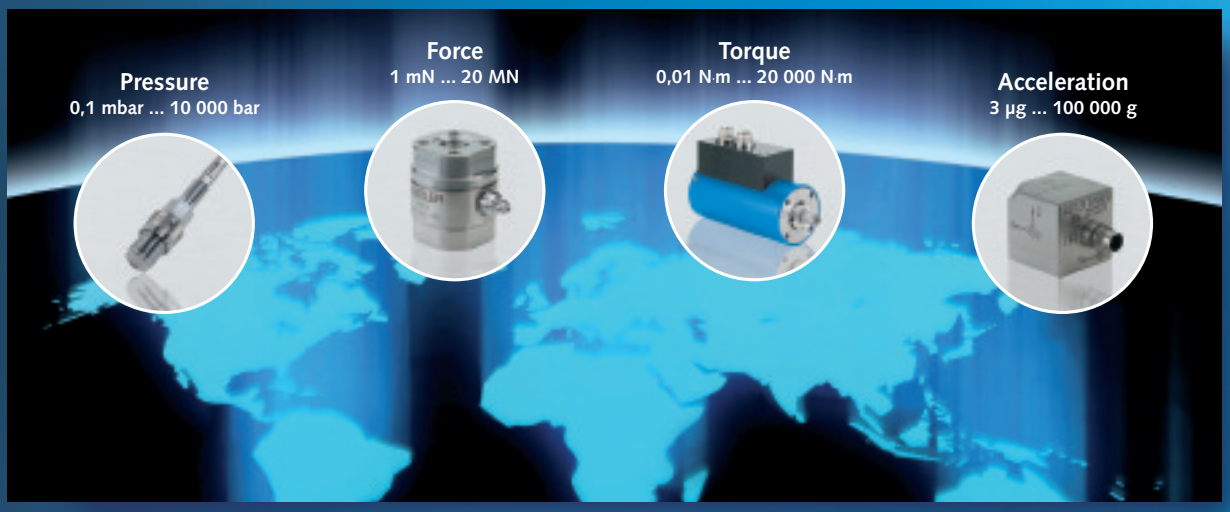

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Blue lasers like it hot

Paul Fanning reports on a new sensor that allows users to measure the displacement of glowing objects.

A laser triangulation sensor using 'blue laser' technology has been launched that allows users to measure the displacement of red-hot glowing metals and other translucent targets.

Micro-Epsilon's optoNCDT 1700BL series of Blue Laser Sensors operate on the laser triangulation measuring principle and use blue (violet) laser technology. The sensors are ideal for measurements on hot, glowing metals, particularly in hot steel processing applications, as well as for measuring organic materials such as skin, foodstuffs, plastics, veneers and wood.

In addition, there are significant benefits to be seen when measuring against translucent objects such as organic materials, paper, some plastics and wood veneers. Unlike a red laser, the blue laser light does not penetrate into the measuring object because it has a lower intensity laser spot and therefore offers more stable, precise measurements on targets that conventional red laser sensors have difficulty measuring.

The Blue Laser sensors are equipped with new high-end optical lenses, a new intelligent laser control and evaluation algorithms. The sensors are suitable for red glowing metals up to 1,600°C, and for silicon up to 1,150°C.

The optoNCDT 1700BL operates using the laser triangulation principle. A laser diode projects a visible point of light onto the surface of the target object. The light reflected from this point is then projected onto a charge-coupled device (CCD) array. If the target changes position with respect to the sensor, the movement of the reflected light is projected on the CCD array and analysed to output the exact position of the target. The measurements are processed digitally in the integral controller. The data is output via analogue (I/U) and digital interface RS422 or USB.

One application to which these sensors are particularly well-suited is in the measurement of brake disc wear and deformation. When a vehicle stops or slows down, the brake discs need to absorb and dissipate the entire kinetic energy of the vehicle. The high level of energy absorbed during vehicle braking transforms into heat, which makes a brake disc glow red hot under load. The shape of the brake disc can deform during braking as higher energy is absorbed. The full extent of this deformation or disc wear can be measured using the optoNCDT 1700 BL sensors.

The wavelength of the blue laser offers significant technical advantages. With red, glowing objects, a conventional red laser has a high signal interference from the brake disc surface, because it emits the same or very near wavelengths of light as the red laser. However, the blue laser works at a wavelength of 405nm, which is far from the red part of the visible spectrum. This means it is easier to filter this type of emitted light from the brake disc, which ensures very stable signals. The blue laser therefore provides a unique advantage when it comes to measuring vehicle brake disc deformation or wear.

Chris Jones, managing director at Micro-Epsilon UK, says: "As well as being the world's first laser triangulation sensor to use blue laser technology, the optoNCDT 1700BL also has an integral controller, which automatically compensates in real time for difficult-to-measure surfaces.

"The sensor's unique real-time surface compensation [RTSC] feature and patented high-speed evaluation algorithms dramatically reduce signal noise. When customers need to measure against hot glowing metals, they can adjust the laser on time of the sensor to give them the optimum exposure time on the CCD for that particular surface. This, in turn, provides a higher accuracy measurement due to lower noise level on the output signal."

www.micro-epsilon.co.uk

Low-cost embeddable accelerometers

PCB Piezotronics has launched a new range of low-cost miniature accelerometers that can be embedded into a wide variety of high-volume and commercial applications such as shock and impact detection of circuit boards or components.

The new 660 series offers high specification measurements from a low-cost accelerometer housed in a flexible industry-standard package. The unique sensors are housed in TO-5 or TO-8 transistor cans to give the end-user a choice of installing the sensor directly onto a printed circuit board (PCB) or to use via flying leads embedded into a system.

With low initial costs and multiple price breaks for volume orders, the 660 series offers an ideal solution for manufacturers wishing to incorporate high specification vibration measurements into their products. The range includes a choice of charge mode, ICP and voltage mode outputs with an optional four-wire device with temperature output.

www.pcbsensors.co.uk

Compact Sick laser protection is ideal for big tasks

Sick (UK) has launched the miniature TiM300 series laser scanner for a wide range of industrial automation, collision-protection and security duties where high performance detection must be combined with maximum reliability.

Although the rugged, metal-housed sensor is only tennis ball sized, the Sick TiM300 is based on the same time-of-flight infrared scanning technology as Sick's highly regarded LMS series of long range laser scanners. The TiM300 also has easy-to-use zonal programming functionality via a USB port or on-sensor buttons, for accurate determination of protected areas.

The TiM300 has a range of up to 4m with a scanning angle of 270°, and can be configured for indication, warning and stopping fields. Its 2D scanning capability enables it to both protect and guide unmanned vehicles and overhead rail conveyors, even on curves. It will also provide presence detection, monitor pallets and load integrity in tight spaces and even guard displays where a discreet or hidden sensor is desirable.

www.sick.co.uk

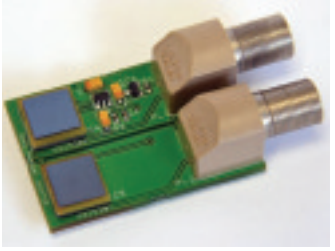
New Plessey EPIC sensor samples made available

Plessey Semiconductors' Electric Potential Integrated Circuit (EPIC) sensors are the first products optimised for use as an ECG sensor and provide a resolution as good as, or better, than conventional electrodes.

The EPIC sensors offer several advantages that save money and speed up taking readings. First, the EPIC sensors are dry contact so that no gels or similar fluids are required to make contact. Second, the sensors can be simply cleaned between uses – unlike conventional ECG sensors that have to be disposed of after every use at a cost of $2 a set. Third, only a pair of sensors are required that are held in each hand which is very quick to do unlike the current approach that requires seven or more leads to be carefully applied to specific locations on the body whilst the patient lies down.

This ease of detection even through clothes or at a distance means that new ways of taking ECG measurements are being investigated by customers. For example, the EPIC sensors could be built into stretchers for immediate monitoring of patients heart rate and respiratory action or built into clothing to monitor stress levels in emergency response personnel such as firemen. As the sensors are very compact and the detection circuitry requires very low power, the EPIC sensor opens up the opportunity for ECG monitoring over a long period of time so that abnormalities can be picked up during normal activities without the stress of being in a hospital or doctor's room.

www.plesseysemi.com



Rotary sensor offers non-contact alternative

Novotechnik's new RSM2800 series provides an absolute position output for up to 16 turns (5760 electrical degrees) - and is a true non-volatile device that retains position in an unpowered state.

Available exclusively in the UK and Ireland from Variohm EuroSensor, the RSM2800 series has clear benefits over single-turn hall effect sensors and offers a competitively priced improvement on contacting wirewound potentiometers and incremental optical encoders that use internal gears for multi-turn angle sensing. Offering much improved reliability and a substantially longer working life than contact based devices, the RSM also has a significantly lower entry cost than absolute optical encoders.

As well as improving the performance and life potential over panel mount 'wirewound rotary motion transducers', the RSM2800 is also aimed at applications throughout industry, agriculture, construction and automotive - from steering angle detection in cars and trucks or mobile machinery, to valve and flap positioning in industrial processing and as a low-cost absolute feedback system for servo controls. It will also be particularly useful in applications where its ability to provide multi-turn absolute position measurement after a power failure is desirable or where a power-up homing routine is not feasible.

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Controllability key to SR motors

Advanced control algorithms are opening up new uses for switched reluctance motors. Justin Cunningham reports.

The basic technology behind switched reluctance (SR) motors has been around for well over 100 years. Their use is pretty widespread throughout industry, although generally it has to be said, in more niche applications.

The Dyson-developed 'world's fastest electric motor' for a hand-held vacuum cleaner was based on SR technology. It is also used in the air conditioning system of European trains as well as in washing machines in laundrettes. Its inherent robustness means that many industries have sought these motors where reliability is the main design driver and the motor is required to keep running for years on end.

SR technology competes with permanent magnet motors and sometimes induction motors for various applications and it is up to engineers to make the trade-off and design decision about which is the most appropriate technology. For some time, brushed and permanent magnet motors have been the accepted electric motor of choice in the automotive industry. However, as the cost of rare earth elements (RREs) has rocketed, both car manufacturers and designers are looking at alternatives to what has almost become the de facto industry standard.

Nick Pascoe, chief executive of Controlled Power Technologies (CPT), says: "A significant element of the bill of materials cost of a high output electric motors is the cost of its rare earth permanent magnets. The cost of rare earth materials, driven by the limited Chinese supply, is now five or six times its level of one year ago, which is driving major price increases for automotive users. This price volatility is a big concern to the automotive industry."

The electric supercharger will facilitate engine downsizing

Dunton-based Control Power Technologies has been developing SR motor technology for the past 10 years and is now taking its technology to market. The company which has its roots in Visteon and Ford has developed quite a niche product using an SR motor at its core; an electric super charger. Although it may sound pretty exotic, with the current evolutionary trend from 'micro hybrid' toward 'mild hybrid' cars – including downsized engines with no compromise to driveability - it begins to make perfect sense.

SR motors basically comprise of a stator and a rotor. The stator consists of coiled sections on the outside of the motor which do not move. The rotor is the movable part of the motor which is continually pulled around as current is simultaneously passed through groups of coils.

SR motors have no permanent magnets and the magnetic field is entirely driven by electricity passing through a coil winding. The stator coils are switched in sequence and that essentially pulls the rotor around. The switching is synchronised with rotor position and, being brushless, it results in inherent robustness. Each group of stator coils is known as a phase and generally CPT opts for a three-phase set up within the machine.

Automotive OEMs are downsizing engines in an effort to reduce fuel consumption and ultimately CO2. To make up the power to weight

deficit of a smaller engine, however, they are tending to add turbochargers. One problem this creates is the lag in the system during the initial drive phase.

Fuel is controlled by injectors and can be scaled up or down with ease. However, it is the air entering the system that limits engine output. If the turbo has not had a chance to spin up, the lag in the system means there is a significant lack of air in the engine intake charge, resulting in less power, even if it is just for a few seconds. As a result, CPT's electric supercharger will kick in during the low revving lag period to pump in extra air, matching the fuel and giving the engine the power output the vehicle needs. So why use switched reluctance motors?

The controllability of SR motors allows the stop-start system to recapture braking energy

"The automotive industry has commonly shied away from SR motors," says Guy Morris, chief technology officer at CPT. "Although the fundamentals of SR have been understood since people began to understand electromagnetism, it has been easier to develop alternatives as in the early years there was little or no capability to precisely control the SR motor.

"Control is everything and that is why electronics and fast microprocessors have been able to change what we can do dramatically. We've developed very sophisticated control algorithms that actually look at what is going on and make tiny adjustments down in the micro-second range. It is quite subtle control."

A big advantage of SR technology is no doubt the lack of rare earth elements inside, but another key strength of the motors is their efficiency over a wide range, which is now coupled with the controllability developed by CPT. Being able to manage the torque ripple, essentially the drop off in rotational force (torque) as the motor is switched between phases during rotation, has been one of the key enabling innovations for SR. The precise control algorithms of CPT have almost negated the torque ripple effect altogether.

They can also be quite flexible in terms of their packaging requirement. They can be very flat or very thin, the 'pancake' and the 'sausage' are two extremes of possible lay outs, CPT has opted to sit somewhere in the middle and the turbocharger looks and feels much like a small alternator.

Following on from the success of the electric supercharger, CPT has also used SR technology to commercialise an Integrated Starter Generator. Essentially, this is a stop-start system that uses an SR motor in combination with advanced lead acid batteries to achieve micro-mild hybridisation. Critically, however, it also allows energy to be captured and generated, enabling regenerative braking.

"This is what a lot of hybridisation is about," says Morris, "being able to deploy one machine to do several functions. Controllability starts to become the big issue for the engineers. On these SR-based systems, you can control almost anything you want."

As part of its commercialisation process, CPT has been able to miniaturise and fully integrate the electronics and control elements so that the unit is almost completely standalone, and bolt-on. Additionally, as the machines have all the control elements integrated inside the casing, they have no issues with electromagnetic energy causing interference, which can completely wipe out the AM/FM radio signal.

"Electromagnetic interference and also acoustic noise are text book concerns," says Morris. "In truth, however, they are very quiet machines. But, like all electric machines, they do have resonant frequencies and we have to manage that through a combination of mechanical design and electronics optimisation.

"Another is air gap. As with most motors the closer you can run, the smaller the gap that the magnetic flux has to act across, the more efficient the machine. But principally, we run the same air gaps as induction motors and our efficiencies are very competitive. So that means we can use standard manufacturing techniques."

The simple fact is that the internal combustion engine will be the drivetrain of choice for many years to come. But the outcome needs to be that less CO_2 being produced. As a result, most of the large automotive OEMs are looking at downsizing engines, as this is one of the most cost effective ways to reduce CO_2 emissions and fuel consumption. But this needs to be coupled will other 'micro-mild hybridisation' technologies to fill any performance gap.

Pascoe adds: "You have to tackle the issue of torque deficit, which these devices can do. We need to maintain or slightly improve performance, since customers will not pay more for less. For the OEM offering an affordable value driven solution is key. It is this evolutionary 'micro-mild' hybridisation that we think is an area that is often overlooked, but could potentially bring the most benefits."

www.cpowert.com

DC geared motors for rotary positioning

The MR geared rotary actuator is a compact, simple and low cost solution for positioning requirements. The range consists of three models of DC geared motors with integrated encoder or potentiometer, combined with worm gearboxes. With IP65 enclosure, a maintenance free design and IEC output dimensions, the MR range suits a wide scope positioning applications such as cameras, lighting, windows, sun blinds and screens.

The first two models in the MR range have output torques of 3 and 15Nm respectively. DC motors at either 12 or 24V provide output speeds from 60 to 500r/min depending on the model and the ratio of the worm gearbox. A two channel encoder built into the motor gives positioning or speed feedback at either 1 or 4 pulses per revolution. Depending on the gear ratio, this corresponds to 12-276 pulses per revolution of the output shaft.

The third model also has a rated torque of 15Nm, but instead of the encoder it has two built-in stroke limit switches that can be set in a range from 20 to 140 revolutions of the output shaft. In addition there is a 5kOhm rotary potentiometer for position feedback. The MR geared rotary actuators are manufactured by linear actuator specialist Linear-Mech.
www.techdrives.co.uk

Integrated brushless servo motor

Allied Motion's integrated brushless servomotor-drive available from Mclennan combines a high power density 75mm diameter brushless DC motor, an integrated all-digital drive and a 4096 count magnetic encoder. The feature-rich EnduraMax 75i motor-drive has both +/- 10 VDC or 4...20 mA command inputs or can be controlled via optional CANopen or Modbus allowing flexibility with system interfacing. The neatly packaged solution for torque, speed and/or position control is available in a choice of three frame lengths and voltages of 12, 24 and 48VDC for continuous rated torque up to 1Nm and speeds to 3900rpm.

The EnduraMax 75i will be useful to both OEMs and end users as a competitively priced automation component for linear and rotary actuators, and for simple distributed motion systems such as parts transport or spacing conveyors. The integrated motor-drive will also be of benefit for machine upgrades - replacing similar sized brushed DC servo motors with much higher dynamic performance together with longer life, reduced maintenance and quieter operation. Its low voltage operation and high motor efficiency will also be of significance for battery powered applications.
www.mclennan.co.uk

Expanding properties

Plastic materials that can expand on contact with water are finding increasing applications in industry. Justin Cunningham reports.

A range of plastics called hydrophilic elastomers have been developed by Elasto, a thermoplastic manufacturer. The material is unusual as it blends a super-absorbent polymer into the base elastomer compound, which causes it to swell up to eight times its volume when immersed in water. The materials have been developed so that, when they come in to contact with water they expand and form a positive seal, preventing the ingress or exit of any moisture.

The company has a range of formulations that offer swell rates between 150% and 1000% when they are immersed in water. As soon as water is no longer present, the compound then shrinks back to its original size. This process of expansion and contraction can be repeated an 'unlimited' number of times, says the company, with absolutely no loss in material performance. Its structural integrity means that it will not erode or shatter over time, which can happen to hydrophilic clay materials.

The material is finding a wide range of uses in industry. An obvious use would be as seals around a car, but it is finding uses in a multitude of industries. Applications so far include water stops, building and construction seals, water treatment plants, tunnels, drains, sewers, tanks, automotive sealant parts, glazing, headlights and cable protection.

David Mann, key account manager at Elasto UK, says: "Like a lot of our products, we find that we have the 'answers', and that although customers have the 'questions' or problems, they don't necessarily realise materials like this exist. So that is part of the challenge."

The temperature, the salt concentration in the water, and the elastomer compound all affect the swell rate.

The material known as Dryflex WS expands uniformly at a controlled rate to a maximum percentage, which can be set when the material is produced. It has the added advantage that it can be made in any colour, is 100% recyclable and can be processed using conventional fabrication methods; including extrusion and injection moulding.

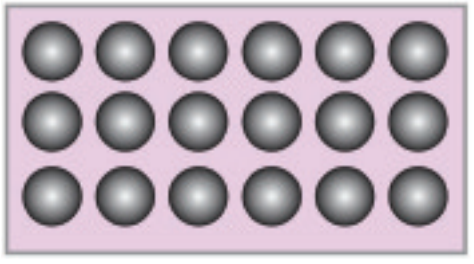
The material can also be made to be antimicrobial; meaning that it kills or inhibits the growth of micro organisms such as bacteria, fungi, or protozoans. Additionally, it can be made to be suitable for saline and alkaline environments making it potentially suitable for medical applications. In an unstressed state the material can operate from -50 to +75°C.

A similar innovation has also recently been published by the Royal Society of Chemistry. A fabric has been made hydrophilic on one side by coating it with nano-titania, a substance which has the property of photo-induced hydrophicity. This essentially means that its hydrophilic property – the ability to absorb and attract water – is controlled by light. When light is taken away the fabric becomes hydrophobic.

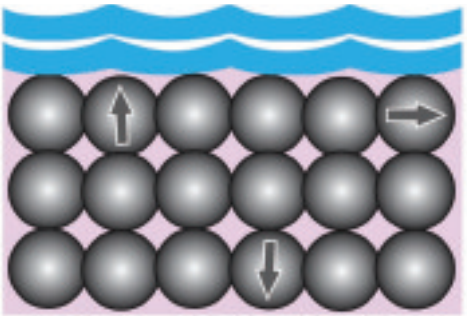
The most immediate application is likely to be sportswear, but the coating has a massive potential to be transferred in to engineering for industrial uses. However, researchers are looking at the potential to use the fabric to wick sweat away from the human skin. Water will be transported in a controllable manner from the dark hydrophobic side (next to the skin) to the hydrophilic side on the outside where it can be spread out. Current materials work by creating a surface energy gradient across the fabric by a pressure difference, whereas this introduces nano and smart elements into the system, taking advantage of titania's properties.

www.elastotpe.com
www.polu.edu.hk

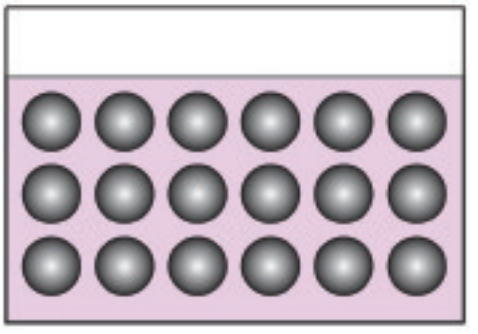
How does it work?



The active hydrophilic ingredient is compounded into the TPE during manufacture



Upon contact with water Dryflex WS will expands uniformly at a controlled rate



When there is no longer water present Dryflex WS shrinks back to its original size

Snap fit and vibration-free for BMW

Justin Cunningham reports on how demountable, vibration-free fasteners ensure that the mirrors on BMW motorcycles give drivers the steadiest view ever.

Specialist fastener manufacturer Bollhoff has recently completed a project with BMW to reduce the vibration experienced on its wing mirrors. With many of the BMW motorbikes able to travel up to 140mph, and accelerate from 0 to 60 in less than 3 seconds, it is vital that the driver has a steady and clear prospective when glancing in the mirror. A shaky rear view mirror is definitely unwelcome and a potential danger.

BMW wanted to increase the on-road safety and optimise the manufacturing procedures of its motorcycles and found a solution for both of these problems with Bollhoff. Its Snaploc fastening system minimises the vibration of the mirror assembly while allowing a quick and easy 'snap-fit' installation that needs no special tools.

The customised fastening solution comprises three Snaploc ball pins which are fitted to the metal frame of the motorcycle. These connect with three mating couplings which are press fitted into the engineering plastic mirror housing and held in place by an undercut.

The ball pins, or studs, are then injection over-moulded in glass filled nylon engineering plastics around steel fasteners whose M6 threads are finished in a black Zn/Ni coating to enhance corrosion resistance. The receiving couplings are precision injection moulded in black EPDM – X: a grade of material that provides resistance to UV exposure as well as positive snap fit and essential vibration absorption properties critical for the application.

Three basic designs of Snaploc couplings have been developed for plate fastenings, for mounting domes and for fixing with adhesive. Different ball diameters accommodate a range of stress conditions while stud sizes and other physical dimensions can be varied to suit application requirements. Ball studs, like this project, are injection over-moulded in engineering plastics around steel fasteners.

When initially designing the fastening system, the major challenge was developing a connection that consisted of a maximum of two elements to almost completely isolate against vibration and noise, while reducing the assembly time compared to traditional fasteners.

www.bollhoff.com

Automotive looks to fastening and adhesives to replace welds

At the recent FAST show in Birmingham's National Motorcycle Museum, the UKs leading fastening and adhesives companies were on hand to chat to customers and sell solutions. Talking to many of the exhibitors it was clear that they are seeing an increasing opportunity in the automotive sector.

German based, Profil, develops complete production processes for its pierce nuts and studs which are fastened to metal shaped parts by means of a riveting process. It says that business was definitely strong in the UK thanks to work it has been doing with Jaguar Land Rover (JLR).

JLR is close to the limit to what it can do with engine efficiency so it is now looking to take as much weight as possible out of its structures. That means moving to aluminium where welding isn't an option; so alternative fastening and joining technologies are being sourced.

Additionally, Tesa UK, a supplier of adhesive tapes, sees much opportunity in this market area. As well as trying to integrate its products in to the production process to replace other methods, it is also finding new applications. It supplies a large OEM with a thin film to cover its vehicles before they get to the showroom. This protects them and leaves no residue, and is fairly straightforward to apply.

Jeremy Smith of Tesa UK says: "We were able to offer a solution that almost guarantees the standard of the cars arriving at the showroom."

www.profil.com
www.tesa.co.uk

Captive screws get some colour

US based Penn Engineering has developed a captive panel screw (CaPS) that is integrated with an anti cross threading feature and a PC/ABS coloured knob to provide easy and quick selection where subsequent access to an assembly maybe required.

The spring-loaded assemblies install permanently in aluminium or steel sheets as thin as 0.92mm can be supplied in self-clinching, flaring, or float mounting styles. Their captive screw design reduces parts to be handled and eliminates risk of screws falling out and damaging internal components.

Knobs can be specified in standard black, red, orange, yellow, green, blue, violet, or metallic. The colours offer the capability to designate service access levels for equipment, colour-reference operating and/or maintenance instructions, or conform to end-use aesthetic requirements, among other possibilities.

The CaPS install easily by pressing them into properly prepared mounting holes. The shoulder on the retainer provides a positive stop. The anti cross-threading screw technology reliably corrects off-angle thread mating and ensures proper alignment. The hardware is available in multiple screw lengths with thread sizes from #4-40 through #10-32 / M3 through M5. A Phillips drive enables tool access and the robust knurled knob allows for hand operation.

Detailed specifications and free CAD part drawings for these RoHS-compliant fasteners can be downloaded from the company's website.

www.pemnet.com

Low-profile compression latch

The IP65 1071 compression latch from FDB Panel Fittings is compact and offers an unusually low profile of only 22mm in its open condition and just 3mm of compression. This enables the benefits of compression lock technology to be achieved in situations where space is at a premium. The device is transferable to many sectors such as vehicle applications or where an interior panel or other equipment requires clearance from the lock cam.

The 1071 provides IP65 sealing and vibration proof operation in left or right orientation with quiet and secure fastening. Operation is by a quarter turn which will latch the cam in position, followed by a further quarter turn which completes the 3mm compression cycle.

The pre-assembled 1071, together with rigid H-section cam, may be quickly and without the need for any tooling, installed in doors of up to 2mm thickness.

www.fdb.co.uk

Mushroom tapes look to replace fasteners

Moving Velcro to the next level, Binder Fastener Systems is trying to encourage design engineers to consider using its Duotec System to replace the traditional fastener.

The Duotec system uses a grid of mushroom shaped studs that snap together; essentially like a press stud, except there are between 40 and 168 mushrooms per square cm. It can be quickly applied to the surfaces that need to be joined by a specific high strength adhesive backing, then the two surfaces can be joined. It provides a peel strength of up to 35N/cm^2 and because any force going in to the tape is uniformly distributed, it mean single point load failures due to fatigue are rare. Additionally, it can be removed and reattached many times without any loss of performance.

The inherent system means that they are very good at damping vibration making them particularly useful in transport applications. And as it sits below the surface, it provides a much cleaner and atheistically pleasing appearance which is becoming much more important to both designers and engineers. Additionally it doesn't need any special tooling to be attached.

Indeed the product has found many applications in road, rail and marine sectors including headlining, fastening of side panels, fastening of interior wall and floor panels, securing instrument panels, removing inspection covers, seat covers, and other interior attachments.

www.binderuk.com

Feeding system installs fasteners during stamping

The Pemserter in-die fastener feeding system is engineered to install self-clinching nuts, studs, and standoffs in assemblies during the stamping process. Working in tandem with a stamping press (and properly tooled die) to feed and install fasteners, this portable system eliminates secondary operations typically required for fastener insertions.

Users can realise increased assembly-line productivity, quality, and savings as two operations (stamping and fastener-installation) can be performed simultaneously in the die.

The Pemserter in-die fastener feeding system is virtually 'plug and play' by utilising multi-pin twist lock connectors to interface with the die and stamping press. The system can be configured for multiple or single insertions, generally matching the rate of the stamping press.

Operators are guided by a touch-screen (for set-up and operation) and online library of fault and help screens. Removable tooling can handle complex workpieces and offers considerable adaptability capable of reaching into areas generally considered inaccessible. Customised tooling can be engineered to meet particular application needs.

www.pemnet.com

READER INTERVIEW

MARK CATTERMOLE, SYSTEMS MANAGER, PARKER HANNIFIN UK

60 SECOND

Q How did you first get into engineering?

A From an early age I have always had a keen interest in engineering, with a strong influence coming from my father, who as a toolmaker by trade, ran his own small engineering company in Lewes. I often used to go after school and watch him at work, and as my competence grew I would have my own projects that I could work on alongside him.

I am always proud of the most simple weather vane I made as a schoolboy that still works to this day in my parents back garden – some 35 years after I made it! With this upbringing I knew engineering was my future career choice.

Q What does your role involve on a day-to-day basis?

A Today, I am the systems manager for Parker Hannifin UK Sales based in Warwick, and my role centres around management of our 'Value Added' activities. My responsibilities are spread across the management of a multi-disciplined team of design engineers, production engineers and assembly engineers involved in the manufacture of hydraulic power packs and hydraulic manifolds from conception to completion.

Q What interesting projects and technologies have you worked on?

A One of the most topical and interesting projects I am involved with at the moment is our corporate support of the Bloodhound SSC project.

Parker was approached by Bloodhound to provide product and technical support in the project to design a 'car' destined to set a new land speed record, with the ultimate challenge being the breaking of the 1000mph barrier.

Q What new technologies excite you?

A The face of engineering is continuously changing, with new technology and boundaries being pushed still further, but I guess the area that impacts my working environment perhaps the most is the area of renewable energy. Parker has been fortunate to be at the forefront of this growing technology with active involvement in both wave and tidal generation projects. I see this as a major growth industry for the future and one that is likely to benefit us long-term.

Q What is the biggest issue/driver facing your industry?

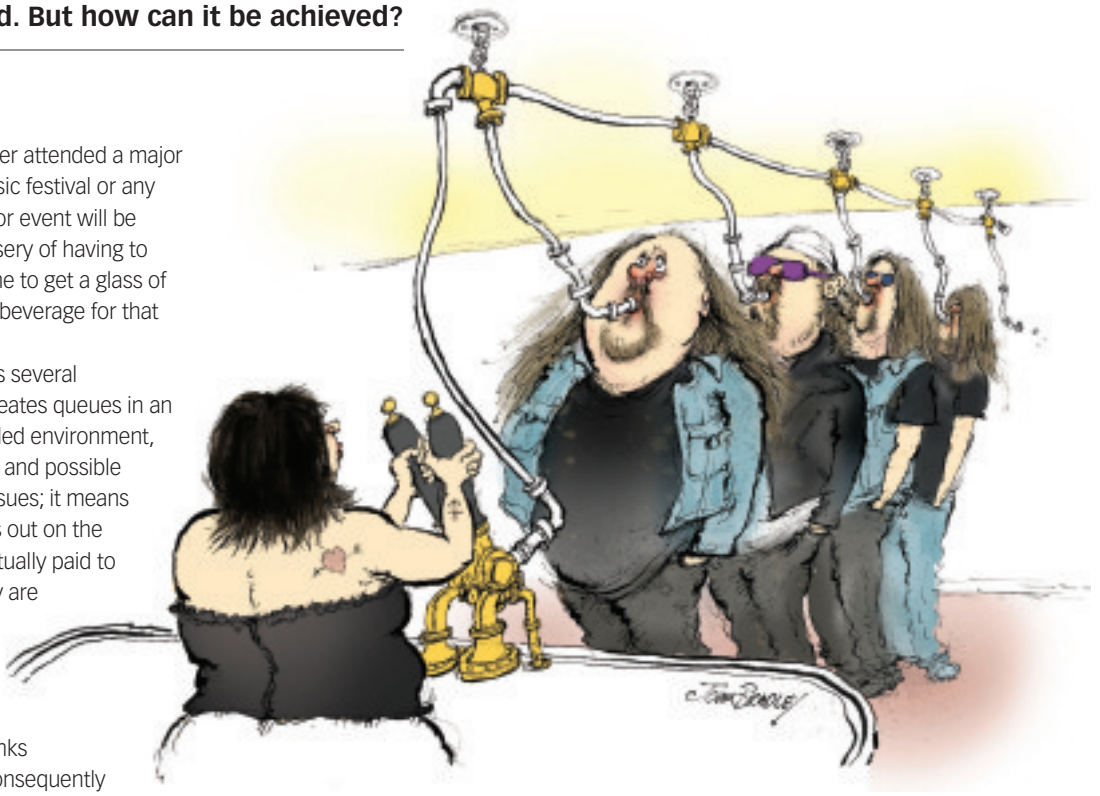
A The UK, along with many other countries across the globe has seen a decline in the number of engineers joining the industry. Statistics will show that a greater number of experienced engineers are leaving through retirement than are joining this critical industry. This is one reason why Parker is so keen to support the Bloodhound project, as it makes one of its primary goals to become the inspiration and catalyst to inspire the next generation of scientists and engineers through an ambitious education programme, taking the project into schools and colleges.

Q How do you see the industry changing going forward?

A As environmental concerns escalate we need to be developing products that anticipate or exceed international directives. I believe that this change will be particularly prevalent in the automotive market as solutions to alternative fuels and the harnessing of wasted energy become the focus for reducing costs and emissions. I see new technology coming, particularly through the innovative strides in material development that will change the way we think and introduce new concepts previously unobtainable.

Raising the bar

Faster, more efficient serving of beer is an idea many would applaud. But how can it be achieved?



Anyone who has ever attended a major sporting fixture, music festival or any other mass spectator event will be familiar with the misery of having to queue for a long time to get a glass of beer – or any other beverage for that matter.

This problem has several repercussions: it creates queues in an often already crowded environment, creating congestion and possible health and safety issues; it means spectators can miss out on the action they have actually paid to watch because they are stuck in a queue for drinks; it can actually put customers off paying for these drinks altogether, with a consequently negative impact on the profits of the venue; and finally, it creates frustrated and unhappy customers!

So where does the problem lie? Fundamentally with the pouring system and the people being employed to do the pouring. Traditionally, beer and cider are poured via a tap system from the top down to the bottom of the glass. This in itself causes a number of problems as it has to be done slowly or the beer will foam up too much, releasing excessive CO_2 and thereby creating too big a head on the beverage, too much wastage, delaying the pouring process even further and presenting the consumer with a flat pint.

Even a skilled barperson can only pour so many drinks at a time, so those in high-demand areas have tended to pre-pour drinks at busy times to try and overcome the problem. This works to some extent, but is attended by a number of other problems. The first is where to store all these pre-poured drinks, the second is the danger of the drinks getting warm or flat as they wait to be bought and the third is that such a system relies on knowing exactly when you are likely to be at your busiest – not always easy.

The Challenge

The challenge this month, then, is to devise a system for pouring beer or other carbonated drinks more quickly while not releasing excessive CO_2, allowing the drinks to stand around too long or requiring excessive numbers of barstaff or requiring those staff to be possessed of unfeasible levels of expertise.

Of course, the solution could be as simple as just building in more pumps, but this is costly and impractical requiring as it does large numbers of staff in a relatively small space. Plus, of course, there are only so many pumps one can fit on a bar. So could a fountain of beer be the answer? One that allows people to scoop their drink out of a constantly running stream? It's an initially attractive image, but such a system would be open to abuse, cause considerable wastage and, one fears, would become insanitary after a relatively short time.

The actual solution to this problem has already been developed, is in use in a number of sites and is apparently simple, but genuinely innovative. It could even be said to have turned the whole problem on its head. However, that doesn't mean that there isn't a better solution out there. See if you can improve on it.

The answer to last month's Coffee Time Challenge of how to generate energy for mobile devices without carrying packs of batteries can be found in the Technology Briefs section on page 12.

Adhesives

www.loctitesolutions.com

Radically Improved Instant Adhesive

Loctite 3090 is a clear, two-part cyanoacrylate that increases the versatility of instant adhesives. Alongside traditional benefits, 3090 allows exposed adhesive outside of the joint to harden within minutes – removing the need for a post-assembly activator. Gap sizes up to 5mm are readily accommodated and the gel viscosity means it's suitable for vertical or overhead application.

It can be used on plastic, rubber, wood, stone, leather, fabric or metal and can withstand a force of 20N/mm². Easy to use, 3090 comes in a pack containing a dual syringe with seven mixer nozzles – and no application gun is required.

@: technicalservice.loctite@henkel.com
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Adhesive Tapes

www.tesa.co.uk

For help and technical advice on our range of double sided, cloth and masking tapes or converted products please phone 01908 500235 for your nearest authorised tesa distributor

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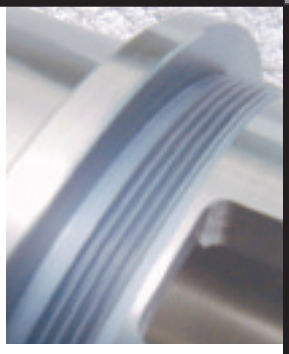
Coatings

www.ws2.co.uk

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.

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www.davall.co.uk

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Constructed with a SMOOTH, FULL STAINLESS STEEL HOUSING (304), fully sealed, lubricated for life and pressure leak tested, and designed to be close coupled to a stainless steel AC motor.

The two styles of gearboxes have a large choice of reduction ratios available, worm series (right angle) from 7:1 up to a nominal 100:1, and helical series (co-axial) from 3:1 up to 60:1, with power ratings up to 4Kw.

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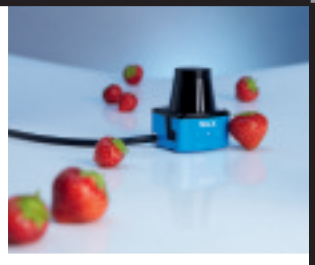

SICK (UK) is launching the miniature TiM300 series laser scanner for a wide range of industrial automation, collision-protection and security duties where high performance detection must be combined with maximum reliability.

Although the rugged, metal-housed sensor is only tennis-ball sized, the SICK TiM300 is based on the same time-of-flight infra-red scanning technology as SICK's highly regarded LMS series of long range laser scanners. The TiM300 also has easy-to-use Zonal programming functionality via a USB port or on-sensor buttons, for accurate determination of protected areas.

@: andrea.hornby@sick.co.uk
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Solenoids and Solenoid Valves

www.pennyandgiles.com

Solenoids and Solenoid Valves

Penny+Giles are a UK based global supplier of linear solenoids and solenoid valves to OEMs in a wide range of industrial markets.

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We design and qualify in the UK, and manufacture in the UK or Asia. Our wide product range includes standard configurable designs in a range of solenoid types, but we also supply modified standard designs to suit specific applications, or unique custom designs for large scale OEMs.

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EUREKA JOBS

THE JOB SITE FOR ENGINEERING DESIGN

For more information on the following jobs enter the reference No. on... **www.totallyengineering.com/eu**

Mechanical Design Engineers: Body-in-White (BiW) - Automotive

Location: UK
Type: Contract, 6-12 months +
Salary: Good, hourly

Multiple Mechanical Design Engineers are required by this leading automotive giant to work on a variety of BiW programmes, UK wide.

Key Requirements:

- Minimum 3 years' experience of Mechanical CAD in industry
- Strong BiW – Body-in-White – Experience.

For full details online enter reference: JSBIW

Hardware Design Engineer

Location: Derby
Type: Permanent
Salary: £35k-£45k per annum

This company is seeking a Hardware Engineer/Hardware Design Engineer who will be involved in the design and implementation of complex digital and mixed signal printed circuit boards for the computer graphics and digital video market. (Board level schematic design experience and high speed Digital design experience are required.)
You will work as part of the hardware design team, reporting to the Hardware Engineering Director, to help define board level architecture and perform signal integrity design and verification. You will have strong Board level design experience/schematic design experience.

Your skills will include:

- Development experience and proficiency in designing and debugging complex electronic circuits that include FPGAs, high bandwidth memory subsystems, digital and analogue video and audio, and Embedded processors
- Strong team skills are required to ensure efficient integration of chip level design (FPGA or Embedded firmware), board level design and PC software.

For full details online enter reference: JS00119

Multiple Mechanical Design Engineers

Location: Birmingham area
Type: Contract
Salary: Very good – hourly

Multiple Mechanical Design Engineers are required by a leading automotive giant, based in the Birmingham area.

The key requirements for this role include:

- **A minimum of three years' experience of Mechanical CAD**
- **Catia V5 experience**

Beneficial experience:

- **Mechanical design experience in the automotive industry**

Other skills and know-how relevant to this position would also be an advantage. The vacancy is for a duration of 6-12 months, with good hourly rates of pay. Start as soon as possible.

For full details online enter reference: JSMECH

Safety & Design for Environment Engineer

Location: Crawley, West Sussex
Type:Permanent
Salary: To be confirmed

Thales UK's Division of Mission Systems provides complete system solutions for all types of fixed or rotary wing aircraft in the civil and military sectors, and for Naval and Land Battlefield Electronic Warfare and Integrated Surveillance systems.

As a system integrator, prime contractor and supplier of value added services, we deliver cutting edge solutions to meet the operational requirement in the fields of combat, surveillance and air transport in addition to regional and business aviation. The company's portfolio includes airborne radars, naval electronic warfare, airborne and naval mission systems, and Integrated Surveillance, Tactical and Reconnaissance systems, some of which include Unmanned Aerial Vehicles.

Primary Purpose of the Role: Design Safety and DfE Engineer, based primarily at Thales Crawley site, developing and managing or conducting safety and DfE programmes for various military systems and product-based programmes.

For full details online enter reference: JS1103892

Product Line Manager – IFE

Location: Crawley, West Sussex
Type: Permanent
Salary: To be confirmed

Division Avionics (DAV) provides complete system solutions for all types of fixed or rotary wing aircraft in the Civil and Military sectors. As a system integrator, prime contractor and supplier of value added services, Thales delivers cutting edge solutions to meet the operational requirements in the fields of combat, surveillance and air transport in addition to regional and business aviation.The Company's portfolio includes avionics, airborne radars, electronic warfare, mission systems, radio and audio communications systems, UAV systems and in-flight entertainment. The AVS Civil Business objectives and interfaces are as follows:

Mission: Develop & Produce competitive SATCOM & Connectivity Solutions for Air Transport, Regional/Biz Jet & IFE markets, either linefit or retrofit Manage the IFE 'TopCare' service commitments within the UK, (especially for the BA IFE contract including On Board Services, Spares management and Repairs.

For full details online enter reference: JS1100182

Mechanical Design Engineer

Location: Bristol
Type: Permanent
Salary/Rate: £30,000-£50,000 per annum

This company is a leading specialist vehicle engineering company and requires the services of a Mechanical Design Engineer to join their highly skilled team. This is a pivotal role to assist in the current and future projects of this world renowned Engineering organisation and become part of some very exciting and rewarding projects, with excellent career prospects.

The company is seeking an engineer who can apply a disciplined approach to the task of design and development of mechanical systems, in particular to vehicle bodywork and chassis mounted components, with a view to achieving National Small Series and Individual type approval under the UK Road Vehicles (Approval) Regulations 2009. It is assumed that you will have experience with computer aided design packages and specific advantage would be gained by being able to demonstrate knowledge and experience with AutoCAD Inventor.

Responsible, through the Production Manager, to the Director for Electro/mechanical design, your duties will include:Provide research and design expertise in the development of company products; Liaise with engineers of other disciplines in order to enhance the cohesion of the final design; Support the assembly and production of company products, based on in-house design; and more.

For full details online enter reference: JS-1094588

Production Support Engineer – Graduate Opportunity

Location: Wallsend, Tyne & Wear
Type:Permanent
Salary: £32,000-£35,000 per annum, plus benefits

This company is the world's leading independent supplier of specialist remotely controlled subsea vehicles and equipment. Serving the oil and gas, renewable, telecoms and military markets, they manufacture a variety of bespoke subsea equipment. An opportunity has now arisen for a Production Support Engineer to join their team. If you're a talented and enthusiastic engineering graduate - this could be the opportunity you've been looking for. In addition to excellent benefits, you'll have the chance to develop your career in a forward-thinking and stimulating environment.

A key member of the production management team, as a Production Support Engineer, you will be responsible for ensuring engineering standards are maintained during assembly. Identifying and implementing process improvements, you will be tasked with diagnosing any technical production problems. Additionally, you will liaise with the engineering function and project managers, ensuring contracts are delivered and quality standards are achieved during product assembly.

For full details online enter reference: JS/301306-SOIPS2511/DS

Hardware Engineer

Location: Bath, Somerset
Type: Contract
Salary: Negotiable

This company has an immediate requirement for a Hardware Engineer to join its development team for a three-month contract, based in the South West.

Essential Skills: General Analogue and Digital Design knowledge

Experience with DC-DC converters or low level power supplies would be an advantage, but not essential.

An understanding of serial interfaces and microcontrollers will be beneficial.

For full details online enter reference: JS-.EH23095

Engineering Manager - Aircraft Products

Location: Luton, Bedfordshire
Type: Permanent
Salary: Competitive, plus many benefits

Are you a talented engineer, with experience of working with aircraft products? Looking to put your skills to use with a company that will give you the opportunity to make a real difference each day? If so, read on.

This company is the world's leading manufacturer of aircraft interior products and solutions, and the world's leading distributor of aerospace fasteners and consumables for the commercial business jet and military markets. An opportunity has now arisen for an Engineering Manager to join their team.

Joining a fast-paced and dynamic environment, as the Engineering Manager, you will be responsible for a management team consisting of Lead Design Engineers and Design Engineers. Working for our client, your ideas, talents and experiences will be utilised for more than your day-to-day duties - they will be used to help shape the future of this global organisation.

For full details online enter reference: JS/301256-BEAEM2511/JG

Mechanical Design Engineer

Location: Wallsend, Newcastle-upon-Tyne
Type: Permanent
Salary: £35,000 per annum, plus benefits

This company is the world's leading independent supplier of specialist remotely controlled subsea vehicles and equipment. Serving the oil and gas, renewable, telecoms and military markets, they manufacture a variety of bespoke subsea equipment. An opportunity has now arisen for a Mechanical Design Engineer to join their team.

This successful company is looking to recruit an enthusiastic and talented Mechanical Engineer, with proven design experience, looking to further their career. As a Mechanical Design Engineer, you will be responsible for producing practical new designs to tight timescales within a supportive team environment.

For full details online enter reference: JS/298885-SMDMD2511/DS

Mechanical Design Engineer

Location: Cambridge, Cambridgeshire
Type: Permanent
Salary/Rate: £25k-£45k per annum

Are you a mechanical design engineer looking to join an industry leading scientific organisation in Cambridge?

In this key role, you will work on the full lifecycle mechanical design of micro-inspection systems, leading a skilled team on all current and future products. The role has a strong emphasis on FEA analysis, so candidates will need to have strong expertise in this area.

You will also need to have a strong degree from a reputable university, and a solid background of working on the design and development of products, ideally within the scientific, medical, high precision or electronic industries.

Salary for the role is dependent on experience. The company will consider candidates from junior to senior level.

For full details online enter reference: JS70333AG

Mechanical Engineer

Location: Cumbria
Type: Contract
Salary: £40 per hour

Job Description:
Execute, evaluate, deliver and manage complex engineering and/or cross functional tasks or programmes of work recognising stakeholder and customer requirements & identify and implement opportunities for personal and team development to ensure that professional capability of the business and individuals are maintained and improved.

Your responsibilities will include:
The production of mechanical systems diagrams (eg air, hydraulics, sea water, cooling water systems) and technical specifications for pumps, compressors, etc, and in addition, produce supporting calculations and undertake design reviews to support the issue of the diagrams.

Supporting the transverse teams (safety, ILS and human factors) in producing the documentation that underpins the design.

Undertaking design reviews and presentations to customers.

Liaising with internal and external customers as required, ensuring that their requirements are adequately supported and that their needs are fully considered and incorporated, where appropriate, and agreed.

For full details online enter reference: JS-.13528/TM

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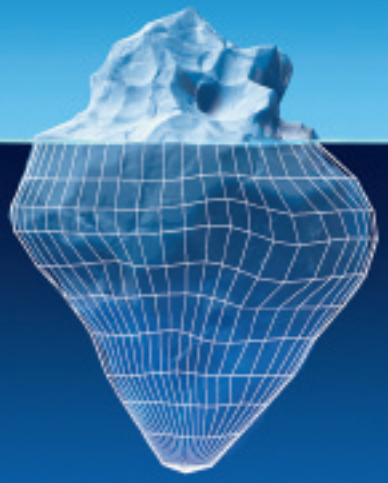

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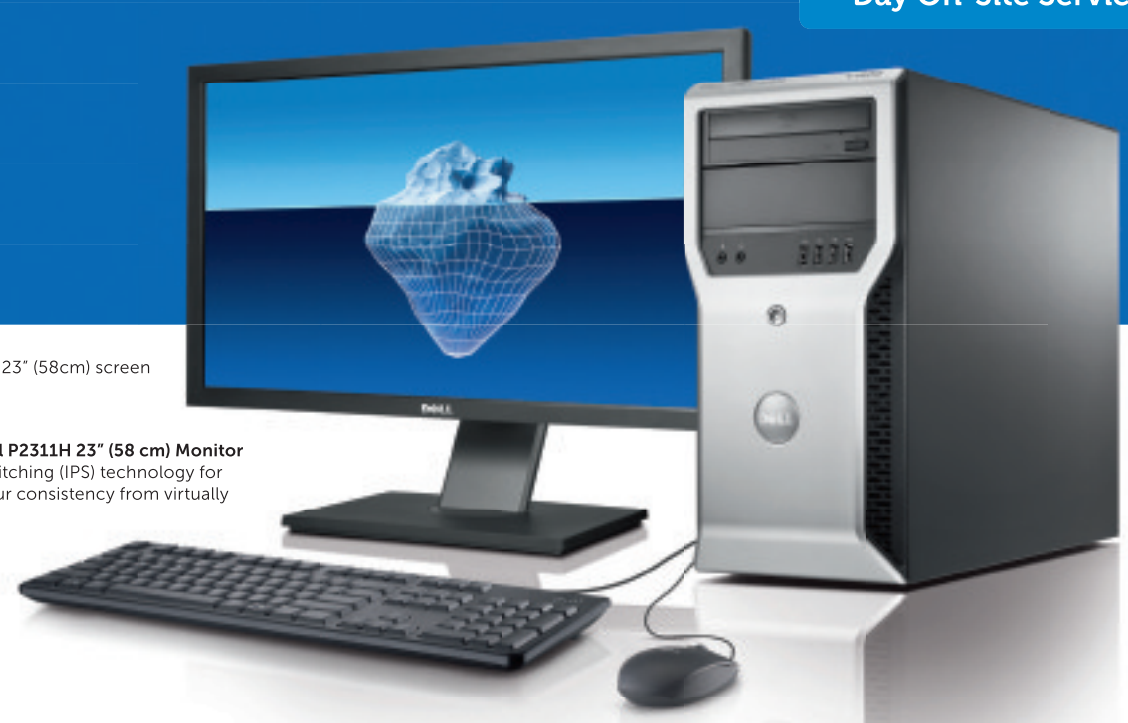

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