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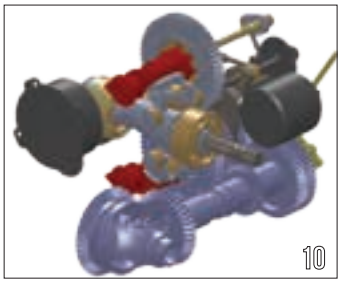

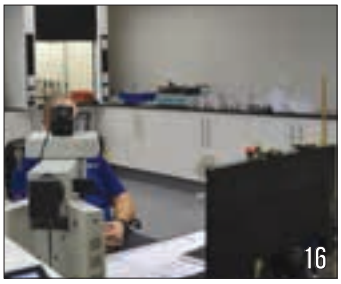

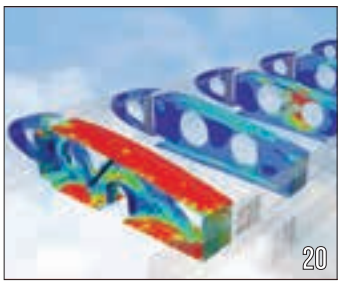

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Industry 4.0 and the retrofit opportunity

Peter Middleton

COMMENT

Cloud computing, the Internet of Things and Services, the Connected Enterprise, Smart Factories, cyber-physical systems, machine-to-machine communication, big data analytics and Industry 4.0 are terms dominating automation and manufacturing industry conferences and expos both here and abroad. How much is hype, though, and how relevant is this 'fourth industrial revolution' to South Africa's manufacturing sector?

I was, therefore, pleased to have been invited to a seminar at Festo this month, presented by Eberhard Klotz, head of Festo's global Industry 4.0 campaign.

At its starting point, says Klotz, it's all about networking, between enterprises, factories, machines and individual components. Why? So that information can be automatically collected, communicated, analysed, compared and used to improve manufacturing performance and efficiency.

Automation and control has always, in principle, been about collecting information and using it to adjust how a machine should respond. Even an automatic kettle uses information from a sensor to 'measure' when the water has boiled and to turn it off.

The revolution, however, lies in the exploding power of our communication networks. It is now possible for a kettle to send you a Tweet when it has boiled – and this exists: it's called a Twettle. The associated software app has a Smart Boil feature – which somehow saves energy – and statistical functions enable the number of 'boils' and the energy used to be calculated.

Industry 4.0, which really represents the European approach to applying these new communication possibilities, concerns itself with industrial production methods. Klotz cites the customisation possibilities that now exist because of the Internet, where people can customise the specification of the car they wish to purchase, for example, and send the information directly to the assembly line.

Aspects of Industry 4.0 are already being implemented at Festo's Scharnhausen plant. These include: employees safely co-assembling with flexible robots; holistic energy transparency systems to track and control energy flows; and the use by service engineers of tablets that are directly connected to the diagnostic systems of machines.

Conceivable in South Africa, asks the sceptic?

It seems so. Klotz describes retrofit opportunities as an ideal way of achieving quick gains from Industry 4.0. Even in Scharnhausen, not all of the machines used were new state-of-the art connected systems. According to Klotz, Festo also wanted the older machines to be connected to the factory-wide network.

But instead of rebuilding each machine, Festo decided simply to add sensors to monitor the areas of interest, connect these to a small Festo CODESYS controller for data collection and conversion and – using the open OPC UA (unified architecture) communications standard – make that data available to the factory's network.

So the existing machines, some being 20 years old, were converted to Industry 4.0 very simply and cheaply: typically for between €4 000 to €5 000.

By comparing production and energy performance indicators, the factory achieved very rapid returns from three key areas. On the production side, information from each machine enabled bottlenecks to be quickly identified, triggering rescheduling, adjustments to the machine performance and continuous work flow optimisation. As a result, buffer stocks and waste could be reduced.

From an energy management point of view, Klotz says that, traditionally, all machines are turned on in the morning at the start of the shift. Also, machines experience peak energy use at specific times during their production cycles. If peak energy use for several machines coincides, then the factory demand also peaks and higher tariffs from the electricity company are applied.

By staggering the switch on times and the production sequences to avoid overlapping peak occurrences, the factory's peak demand was significantly reduced. "This is so easy if you have the information, but impossible if you do not," Klotz points out.

A third area of direct saving was enabling better utilisation of available waste energy sources. The galvanic baths, for example, had to be heated every morning before use. By simply waiting a few hours until the solar systems had started to generate power, utility energy use was reduced. It was also possible to identify and use waste heat energy, from machines such as compressors, for pre-heating. These changes resulted in a reduction in energy use of one third, a saving of about 1.0 GW, and a cost saving of several million Euros.

It is not necessary to build revolutionary new factories in South Africa to implement Industry 4.0. By employing relatively cheap communication and monitoring strategies, we can retrofit the communication technology and harness these modern principles to better manage production and associated resources. ❑

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The diamond in level measurement

Reliable level measurement under extremely harsh conditions is now possible thanks to VEGApuls 64 radar level sensors. This article highlights the exciting example of the instrument's use in diamond ore processing and the advantages one operator was able to gain by switching to radar level measurement at 80 GHz.

The dense media separation (DMS) process is a special flotation process in diamond ore processing. Dust and dirt are, among other things, the major factors that adversely affect level measurement in the flotation tank.

The Maluti Mountains in the Kingdom of Lesotho is home to the highest diamond mine in the world at 3 200 metres above sea level. The environmental conditions there are correspondingly rough, with frequent, abundant snowfalls, temperatures that fluctuate between -18 °C and +20 °C and strong winds that intensify the low temperatures being part of everyday life.

The conditions in the ore preparation process are also pretty rough. The mine transports the ore to the surface through two kimberlite pipes. These are vertical chimneys of volcanic origin that extend deep into the earth's crust. The source rock is crushed and further processed to extract diamonds. This whole procedure is extremely laborious. Worldwide production of natural diamonds is now about 20 t per year but covers only about 23% of industrial demand. The rest is manufactured industrially.

The two pipes in the Lesotho mine contain only a very small proportion of diamonds. Their yield is less than two carats per hundred tonnes of rock. A huge effort is required to get at these diamonds. In the mine, 70% of which belongs to Gem-Diamonds and 30% to the Lesotho government, 5.8-million tonnes of ore are processed per year in two plants. An additional 1.2-million tonnes are mined and processed by a contractor at a separate plant. The combined tonnage produces approximately 100 000 carats per year. Approximately 18-million tonnes of rock that cannot be used for anything are left over each year.

The smallest antenna of the VEGApuls 64 is no bigger than a one-euro coin. This makes the new radar sensor ideal for installation in small wells and containers.

The Maluti Mountains in the Kingdom of Lesotho is home to the highest diamond mine in the world at 3 200 metres above sea level.

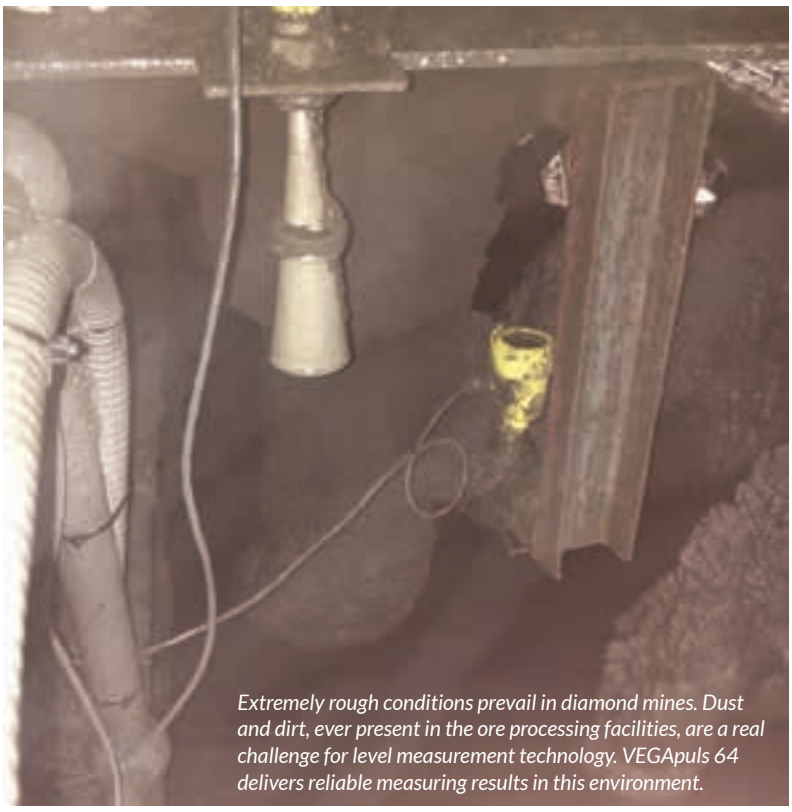
Separating diamonds from kimberlite

In a DMS plant, ferrosilicon – an alloy of iron and silicon – in powdered form is suspended in water to obtain a fluid with the same density of diamond, about 3.52 g/cm^3. To this is added the previously crushed diamond bearing material, in order to separate the heavier minerals from the lighter rock. The DMS process produces a concentrate, which generally amounts to less than one percent of the original material fed into the plant at the beginning of the process. An alternative processing method is centrifugation, where the denser material is swirled at low and high speeds in cyclones. In the process, the diamonds and other dense minerals are pressed to the walls and then out the bottom of the cyclone. The wastewater rises at the centre of the cyclone and is sucked out and screened to remove the remaining particles.

Both methods have their advantages and disadvantages. The investment costs for a DMS plant are ten times higher than for a cyclone. The DMS plant, however, provides better yields. The water consumption and operating costs for a DMS plant are also significantly higher than is the case with centrifuge processing.

However, the service life of kimberlite mining facilities is very long, which makes it

Thanks to VEGApuls 64's narrow beam angle of only 3°, false echoes caused by internal installations are no longer a problem.



Extremely rough conditions prevail in diamond mines. Dust and dirt, ever present in the ore processing facilities, are a real challenge for level measurement technology. VEGApuls 64 delivers reliable measuring results in this environment.

worthwhile to build stationary infrastructure that, in the long run, leads to higher productivity of the overall process. Of course the efficiency of a plant also depends on the skill of the operator and the applied technology. Decisive factors for the smooth operation of a DMS plant and, ultimately, the whole process, are, among other things, a high level of automation and measurement technology that can deliver reliable measured values.

Turbulence and inlet tubes make measurement more difficult

In the flotation tank, the level of the flotation liquid containing the enriched material has to be precisely measured. However, this is far from easy because of the harsh environment and the internal components of the tank. The medium is fed into the flotation tank through pipes from different directions. These pipes cause extreme turbulence and water splashing inside the tank.

An older radar sensor with a transmission frequency of 26 GHz, which was installed there a few years ago, always had problems. For example, it displayed the built-in pipes as the level, which was totally incorrect. Another difficulty was the accumulation of dust and debris on the antenna, which resulted in false readings again and again. Although radar technology is a non-contact measuring method and therefore ideal for dirty environments, the sensor no longer worked optimally because of the extreme ambient conditions. Due to the resulting signal attenuation and interfering reflections, the measuring point could only be kept in operation through constant servicing.

80 GHz technology brings stable measurement

Last spring, when the first 80 GHz radar level sensor for liquids was introduced to the market, VEGA's South African subsidiary quickly suggested replacing the existing technology with the new VEGApuls 64. The previous 26 GHz sensor, with its 80 mm antenna, had a beam angle of 10°. It was mainly the narrower beam angle of the VEGApuls 64, only 3.0°, that promised a solution to the problems caused by the inlet pipes. This considerably tighter focusing of the radar beam made it possible to better distinguish the actual measurement signal from the interference signals. The new radar sensor also has significant advantages because of its higher dynamic range of 120 dB. What is more, VEGApuls 64 provides higher accuracy, reproducibility and reliability in general within the application.

The measuring process itself is completely independent of process conditions, which is one of the greatest advantages of radar technology. Varying temperatures and pressures affect the measuring results just as little as the properties of the liquid to be measured, e.g. density or viscosity. This is important, especially in the inhospitable temperatures that prevail in the diamond mine.

VEGApuls 64 measures under pressures from -1.0 bar to +20 bar and process temperatures between -40° and +200 °C. Despite the considerably shorter wavelength of the 80 GHz sensor, it is hardly affected at all by deposits or condensation. This is achieved mainly through special signal processing in the area close to the sensor. The distance-dependent dynamic adaptation reduces the effects of interference directly in front of the antenna system and at the same time allows very high signal sensitivity at a greater distance. The measuring distance can be up to 30 m with measurement accuracy still remaining at ±2.0 mm.

Problems in the mud bath?

Besides the exceptional stability of its measuring signal, the radar sensor is also characterised by mechanical robustness, i.e. it is virtually wear- and maintenance-free. Even if the sensor has to be freed of large quantities of mud now and then, the process can go on unhindered. Cleaning is fast and uncomplicated.

In conclusion, the extraction and processing of diamond ore definitely has nothing to do with the glittery glamour world where the diamonds later make their grand appearance. The environment in the mine is harsh and forbidding. But what really matters here is the efficiency of the process. For the mine operators, the very idea that a process would have to be interrupted just because of a defective measuring instrument is unacceptable. They are keenly aware that most of the mining and extraction processes are interconnected and depend heavily on each other.

The first 80 GHz radar level-measuring instrument for liquids has proved to be a real godsend for the mine. Everything in the flotation tank has been running smoothly since the VEGApuls 64 was installed.

A PROCESS webinar with numerous application examples about why radar level measurement with 80 GHz technology is suitable for use in process automation in different areas of industry is available for viewing at process.de/webinar and more about 80 GHz can be found at www.vega.com/radar. ❑

Chem Eng and the bigger picture

MechChem Africa talks to Alan Cousins, who has been member of SAIChE for over 30 years and, for the past ten years, the chemical profession's representative on the professional advisory committee (PAC) for ECSA.

Alan Cousins was born and educated in Zimbabwe. "I completed A-Levels in Zimbabwe in 1979 in pure and applied mathematics, physics and chemistry. Then I was in the last call-up for national service and was commissioned into the new Zimbabwean army, where I spent most of my time getting my colleagues released early," he tells *MechChem Africa*.

"After completing national service, I wanted to go overseas to study in the UK, but it was just at that time that Margaret Thatcher pulled the funding plug on overseas students and I couldn't afford it," he continues. "So I applied for and was awarded a Union Corporation bursary to come down to University of Cape Town to study Chemical Engineering.

"I came to South Africa in 1981 and graduated at the end 1984. At about that time, Union Corporation merged with the General Mining and Finance Corporation to become Gencor. On completion of my studies, I joined Gencor as part of my bursary obligation and ended up going to Impala Platinum's precious metal refinery in Springs, where I worked from 1985 to 1987," he reveals.

For a young graduate interested in chemical processes, "this was a good place to be". The options for a young chemical engineer in a mining company at that time were gold or PGMs (platinum group metals) and "I wasn't too impressed with the chemical engineering involved in gold processing," Cousins explains.

"The Springs precious metal refinery was a place with an intense chemical engineering focus at that time. A whole chain of extraction processes was being used to separate out the different metals, including solvent extraction; inorganic leaching; ion exchange; and calcining. The refining processes were much more chemical extraction focused than those used for gold," he explains.

"PGMs are really hard to ionise, but when they do, they form some amazing compounds. Iron has Fe^{2+} and Fe^{3+} ionisation states, but PGM metals can form ions with a charge of 2+, 3+, 4+ or 5+. These all form different complex salts, so the R&D side is fascinating," says Cousins.

"In those days, PGM extraction was fairly primitive, involving Aqua Regia leaching, salt precipitation and the emission of significant amounts of sulphurous and nitrous oxides (SOx and NOx),

Outlining the process used, Cousins says that mined PGM ore is first concentrated by flotation and then converted in furnaces to a form that can be leached. The resulting metal, called matte, consists of a mixture of platinium, palladium, rhodium, ruthenium and iridium (the PGMs) but it also comes with nickel, copper and small quantities of gold.

"At the first stage, a high temperature acid pressure leach process was used to preferentially dissolve the copper and the nickel from the PGM Group metals. This dissolved leach then went for further processing – electro winning – to extract the copper followed by precipitation to recover the nickel.

"The residue from the pressure leach process, a dark grey sludge, was placed into an Aqua Regia leach, a mix of nitric and hydrochloric acid, named because of its ability to dissolve gold. Aqua Regia, which was used to preferentially dissolve out the platinium and palladium, is associated with some very toxic fumes, though," Cousins says.

"From this leach, complex platinum and palladium salts were precipitated, which are particularly allergenic. I only ended up on the platinum side of this process because I survived all the allergy tests during my medical," he notes.

Once the platinum and palladium were pulled out, the remaining PGMs – rhodium, ruthenium and iridium – were extracted, via a combination of ion exchange and solvent extraction principles, "but there were not yet mature markets for these metals," he adds.

All the individually precipitated salts then had to go through calcining furnaces to reduce the metal ions into pure precious metals.

"This process was not sustainable, though, from the environmental side, owing to SOx and NOx fumes and, because the salts were allergenic, many of the employees involved became allergic causing staff turnover to be unsustainably high," Cousins points out.

During his third year at Gencor, Cousins moved into the project environment to address the inadequacies of the Springs extraction processes and doing the front-end design of a new platinum refinery.

"What this gave me was the basis for the rest of my career. The department was run on an EPC basis and the manager, Grenville Dunne, used multi-disciplinary task teams, including all the engineering disciplines, project engineers and process engineers," Cousins recalls.

"I was involved in big-picture development: calculating mass, heat and energy balances; preparing process flow diagrams (PFDs) and piping and instrumentation (P&I) diagrams; and designing process equipment. It was great exposure to a wide range of engineering tasks," he tells *MechChem Africa*.

In 1987, Cousins moved to Fluor in Sandton, Johannesburg, to a join a team involved in the early development of PetroSA's Mossgas refinery.

The EPC years

After becoming engaged in 1987, Cousins moved to Fluor in Sandton, Johannesburg, to a join a team involved in the early development of PetroSA's Mossgas refinery. "I joined Fluor to carry on doing engineering design. I wanted to get into oil and gas – the distillation columns and the plant side of chemical engineering – and I quickly became involved in the very early PFD and simulation design of the Mossgas project."

The refinery was being built to further process synthetic crude oil being produced from the offshore gas in Mossel Bay using the Sasol-developed Fischer Tropsch process.

After 18 months at Fluor, Cousins took a leave of absence from Fluor and, with his new wife, spent 18-months travelling and working around Europe. "I worked for Fluor in the UK for three months during that time, as a contractor, which was of benefit later in my career from a networking point of view," he says.

After returning to South Africa, he rejoined Fluor and spent the next 29 years honing his EPC skills. "I was a full-time employee at Fluor until December last year, when I took a voluntary retirement package and became a consultant to them. I have worked on many different projects over the years, built up good networks with overseas expats and learned a lot from them.

"Fluor has done an excellent job of building a knowledge base. It has used the wealth of expertise from engineers with 30 to 35 years experience who were due to retire, those involved with Sasol 2 and 3, for example, as well as other high profile projects all over the world.

"Fluor has effectively captured this knowledge in a huge database and they also now use their people as subject matter experts. An engineer from anywhere in the world can post a query with a selected scope and a subject matter expert will respond within 48 hours. This is a superb modern tool," Cousins says.

Giving advice for youngsters, Cousins says the strength of South African engineers, "is that we are very good generalists. We love the overview, the early financial modelling, the feasibility studies, the conceptual design, etc. I have very seldom done anything more than twice, which forces one to become a 'Jack-of-all-trades'."

Citing the experience of his godson who graduated in 2015, Cousins says that, having failed to secure a job in chemical engineering, he talked to people in the financial sector, who persuaded him to take a short course in financial management. He is now employed in the banking sector.

"Engineers are taught to tackle problems in very systematic ways: investigate the problem; identify solutions; test solutions; evaluate them; and then implement. Chemical engineering forces one to look into systems in detail. Chemical engineers tend to know the big picture because the actions of everyone upstream and downstream of the process affect one another.

"Not many other professions offer this skills set. So the financial sector often prefers to take in engineers and teach them the necessary financial skills," he says.

"When I graduated, the career of a qualified chemical engineer was very well mapped out and fairly narrow. Now, however, engineering skills are applicable and recognised everywhere and chemical engineers are being poached into careers across the spectrum.

"If you like coming up with solutions to practical problems, there are only a handful of professions that are available to you, with chemical engineering being one of them. And you will never be trapped watching fumes come out of a vessel. Today's chemical engineers end up taking posts in management and financial sectors as well as in the development of numerous interesting new technologies and plants," Cousins advises. ❑

Gauteng Members Group's process safety talk

On 15 February 2017 the Gauteng Members Group of SAIChE-IChemE arranged a talk on the topic of process safety. The speaker was Trish Kerin, who is the full-time director of the IChemE Safety Centre (ISC).

The ISC is a consortium of members from operating companies, consultancies, academic institutions and regulatory bodies, whose objective is to improve process safety practice across the chemical industry.

Trish Kerin is a mechanical engineer based in Australia who has worked in the oil, gas and chemical industries as a process safety specialist. She has worked in Australia and throughout Asia and is a Professional Process Safety Engineer with IChemE.

Kerin spoke about the ISC framework for process safety, which is based on the foundation that good performance in process safety must be built on leadership across six elements: the more 'technical' ones of knowledge and competence; engineering and design; systems and procedures; together with the 'softer' elements of assurance; human factors; and a healthy safety culture. ❑

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Technical know-how and best-fit

MechChem Africa talks to Burtie Roberts, CEO of BI – formerly Bearings International – and the company's head of products and engineering, Ross Trevelyan.

"The South African economy remains depressed, but at BI, we remain optimistic for several reasons," begins Roberts.

First among these is that BI has a history of focusing on South African markets. "While many component suppliers are looking north, we believe there is still a lot of local mileage with respect to growth," Roberts tells *MechChem Africa*.

Also though, "BI's market share for many of our brands is lower than we feel it should be but we see this as a huge opportunity for growth. So we are on a mission to raise awareness of our brands, the underpinning technical knowledge, the advantages of our products as well as our superior servicing levels," he says.

"We are not yet ready to spread north of our borders, because we still feel that we ought to remain 100% committed to local markets until we achieve the penetration and service levels that South Africa deserves," Roberts notes.

Describing the change in market conditions over the past five to ten years, he says that conditions have become much more challenging due to an expansion in the numbers of companies offering engineering component distribution services as well as the increasingly cost-constrained conditions being experienced by equipment operators. "It has become increasingly difficult to differentiate one's offering in today's industrial environment," he adds.

In response to this difficulty, he says: "We have repositioned ourselves towards being a preferred supplier to our customers as opposed to being component or brand suppliers. It's a broad concept, one that incorporates a host of different products and brands to best suit the holistic needs of a plant or customer.

"The concept relies on strong trust-based relationships, stock availability and technical know-how so as to provide, not only products but solutions, backed up by cost-effective quality brands. We don't really like arguing about which brands are best. Instead, we strive to offer the product that best suits the need: with respect to the specific application; the duty and life required from the product; the cost imperatives of the operation; and the risk factors involved.

"We have access to a number of different suppliers of interchangeable components. On our entire range, we now run with premium European and Japanese brands and lower-cost equivalents from eastern countries such as China. This gives us the flexibility to evaluate the most cost-effective solution for applications based on the full set of operational requirements and risks," he explains.

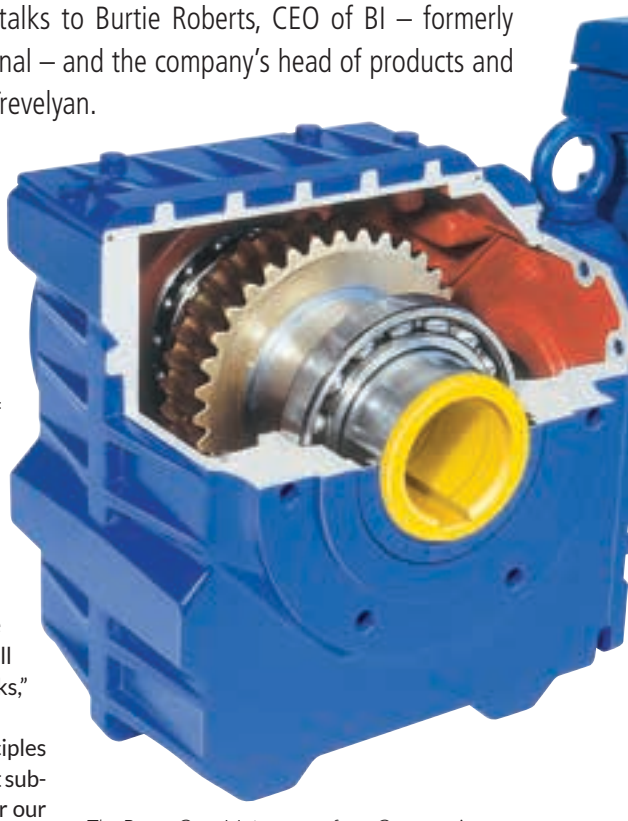
Total-cost-of-ownership (TCO) principles are inherent in this approach. "We invest substantial amounts on internal training for our sales people to evaluate market sectors and, in cooperation with our suppliers, to spread the advantages of each product and brand. In principle, we want all of our sales people to be able to recommend a best-fit solution rather than simply selling one product," continues Trevelyan.

"As well as being vital that our sales teams have a sound understanding of products across the range, it is also essential that they are able to listen, to fully understand the needs of our customers so that we can sell total solutions from our extensive product range that cuts across the price and quality spectrum," he says.

Roberts continues: "We understand the frustration customers have when several sales representatives arrive trying to sell specific brands based on price competition alone. Having the technical know how and the flexibility to offer multiple solutions across the full price range allows us to offer a mix of product brands that, combined, best meet the requirements.

"We believe success is related to customers' overall experiences: from the point when they engage with us, past the point when they receive and install the components and through to making sure that, by the time an account statement is sent, all of their needs have been fully met," he adds.

Says Trevelyan: "Going beyond the single transaction, we see ourselves as forming long-term partnerships based on high levels of trust and competence," he says. "The success of a brand can no longer rest in the personal relationship with a company's sales representative. All companies now insist on hard value for their purchases," he notes.



The Bauer Gear Motor range from Germany is one of BI's premium product offerings.

Citing the long-term supplier relationship with a leading South African petrochemical company, he says: "This relationship has always been genuinely based on the products and the technical services we are able to offer. We now have a supply agreement on a range of components used by the company's plants on a regular basis, along with the associated maintenance and other value adding services," he informs *MechChem*.

Roberts goes on to highlight the company's success with the Japanese Koyo bearing brand. "We have been the exclusive supplier of wheel hub assemblies for a leading local vehicle manufacture – for its passenger and 4×4 vehicles – for many years. Here, continuity of supply is the key service – regardless of strikes or delays or any unexpected delivery issues – and we have never failed to deliver," Trevelyan notes.

"We are a Tier 1 and a Tier 2 supplier to the South African automotive industry, supplying wheel hubs directly to assembly lines from our Parkhaven premises in Gauteng and components such as differential bearings to local

solutions

Also on offer is the local in house BI Bauer brand of electric motors.

Cooper angled pillow block split bearings, a premium-brand product available though BI.

Tier 2 manufacturers all over South Africa.

"Also, while the Koyo brand is well known in the automotive space, we also offer a Koyo industrial bearing range. A fair number of these are being used in the petrochemical industry, for example, for pumps and motors. They offer a high-quality and cost-effective direct alternative to European brands," Roberts notes.

At the lower end of the bearing price range, according to Trevelyan: "BI has a long standing partnership with KML of China. We found areas in the market that were under intense price pressure – most notably the agricultural sector and the automotive aftermarket – and we needed a product that could perform better in these environments while remaining cost-sensitive. But with respect to product coming out of the East, one has to be very careful about product quality.

"In partnership with KML, we put in place some quality criteria, procedures and tests to ensure consistently high standards were maintained and, as a consequence, our KML brand is one of the leading lower-cost options available," says Trevelyan, adding that the quality of the KML product is "unquestionable".

"In the Group we have a mechanical engineer based in China who is responsible for consolidating and, in many instances, direct sourcing of suitable components and brands. He then does the quality vetting and management to maintain the healthy relationship with all our manufacturing partners in China," Trevelyan adds. "If any local operational problems do arise, BI's engineering department feeds these issues back to China for long-term resolution.

"Our engineering business unit offers full product support as well as customisation, product selection and design services. We can also offer onsite installation assistance or full installation services," he adds.

"This does not only apply to bearings," continues Roberts. "We offer competitive cost options for PTOs, gearboxes and geared motors, belts, chains and a host of other transmission and drive-train components."

On the gearbox side, Trevelyan cites the Bauer geared motor range from Germany as a premium offering. "We also offer the Dodge bearings and power transmission products, including the unitised easy to mount and maintain bearings, and the Dodge gearbox range, which offers industrial bevel-helical and shaft-mounted gearboxes for industrial applications.

"The BI Motodrive brand is an eastern gearbox range, which includes worm drives, and we have recently added the TR range of economical geared motors that are interchangeable with common European brands," he adds.

BI also offers its local in-house BI Bauer brand of electric motors: "These are excellent general purpose electric motors in standard frame sizes for general industrial applications," Trevelyan explains.

BI supplies Jaure gear couplings and transmission elements that are ideally suited to the pulp and paper industry.

Also offered is a comprehensive range of couplings: Rexnord Omega and Viva elastomeric couplings; Ringfeder Tschan claw/jaw couplings; Jaure Lamidisc and gear couplings; and KTP grid couplings as well as a range from Mayr in Germany. "We also supply and support Elecon fluid couplings, another good quality Eastern alternative to the European fluid coupling brand," he adds.

Roberts concludes: "We sell motors, gearboxes and everything between, including the bearings inside. While we have shifted away from offering only premium brands and we have, for many years, been offering much more than bearings, FAG, Koyo, Rexnord and Cooper remain key accounts for us.

"As BI, we remain a quality product distributor. But instead of relying only on a premium offering, we now strive to supply the correct product at the most appropriate quality level with a view to making our customers' operations as cost effective as possible," he says. ❑

A revolutionary CVT is

Varibox CVT Technologies, a South African Intellectual Property (IP) company, has recently received search report feedback from a PCT (Patent Cooperation Treaty) application for its RADIALcvt design in which all 12 claims have been granted without modification. *MechChem Africa's* Peter Middleton talks to Jan Naude of Varibox, the company's managing director and principle inventor.

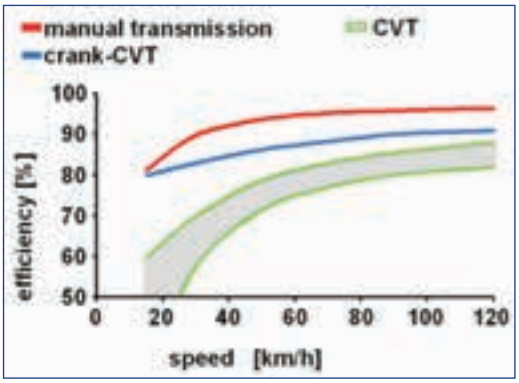
Varibox CVT was set up in 2007 to develop 'out of the box' continuous variable transmission (CVT) solutions: identifying the shortcomings in main stream CVT system and addressing these shortcomings at a fundamental level by inventing patentable design alternatives.

"The first CVTs were invented in the 1960s in The Netherlands. These were based on using two variable diameter pulleys connected by a thick rubber belt. Each pulley consists of two interconnected conical halves that slide towards and away from each other. When the cones are apart, the belt runs closer to the shaft axis and vice versa. By synchronising the driver and the driven pulley so that the driver pulley gets larger or smaller while the driven pulley gets smaller or larger, the speed ratio can be continuously varied," begins Naude.

When connected to an engine management system, CVTs offer an alterative to fluid-based automatic transmissions or automated manual transmissions (AMTs), but CVTs are stepless and do not require individual gears to be engaged and disengaged.

Fast forwarding to 2016, Naude says Bosch now owns the intellectual property for pulley-based CVTs that now use metal bands instead of the rubber belts. These run using a traction fluid that separates the metal band from the metal pulleys. An alternative is available from LUK, which uses a metal chain instead of the belt. "All current CVT systems available in modern motor vehicles use one of these two pulley-based systems," he tells *MechChem*.

Identifying the shortcomings of these systems, he says, at any time, the two halves of each pulley are kept at the required distance apart by an automatic hydraulic clamping system. "The position and the clamping force has to be very accurately controlled, so hydraulic pumps and control systems are required to continuously vary the effective drive- and the driven-pulley diameters.



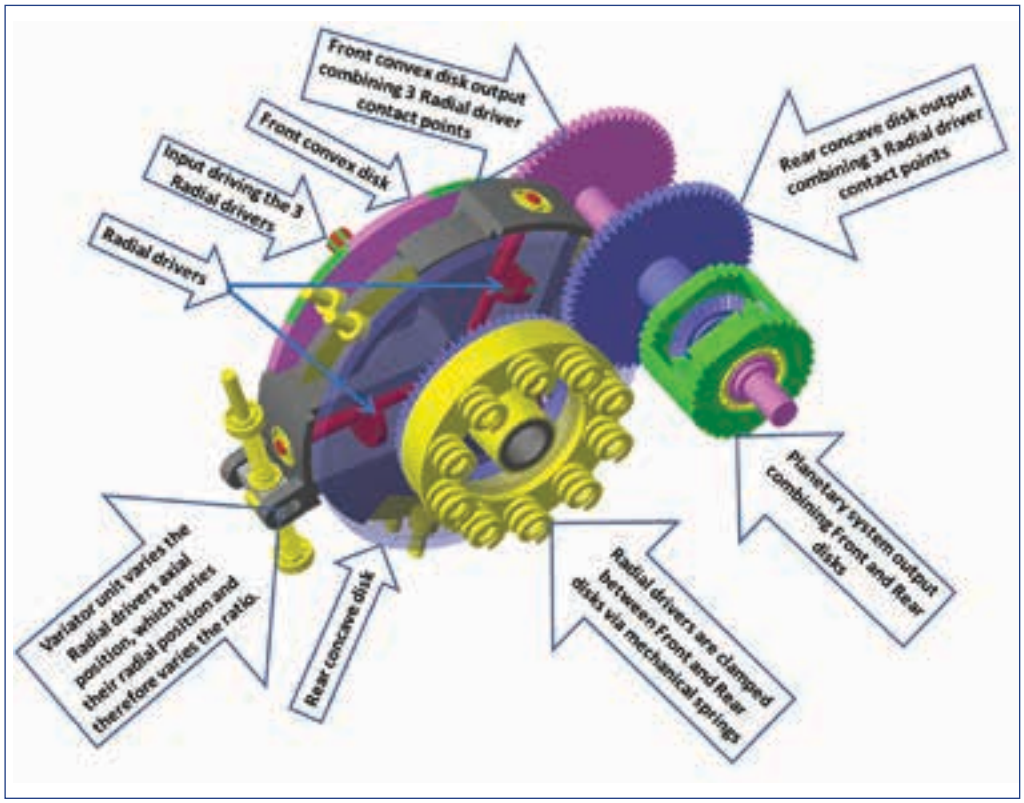
"Efficiency losses are usually evaluated at the maximum power point, which is a bit misleading," says Naude. "A 100 kW CVT might be 95% efficient when transferring 100 kW, but if only transferring 20 kW, its efficiency is much less," he says.

Reference: LuK Symposium 2002: Crank-CVT_de_en.pdf: Figure 11.

Since the pulley radii both vary, the hydraulic clamping forces also have to change depending on the steel belt's distances from the rotating shaft axes. This adds a level of control complexity to the hydraulic system, raising its costs.

"These CVTs also have two friction drive systems operating in series. The power from the engine comes into the first pulley set and has to be transferred to the band or chain. This is then transferred to the driven pulley at the second friction interface," Naude explains.

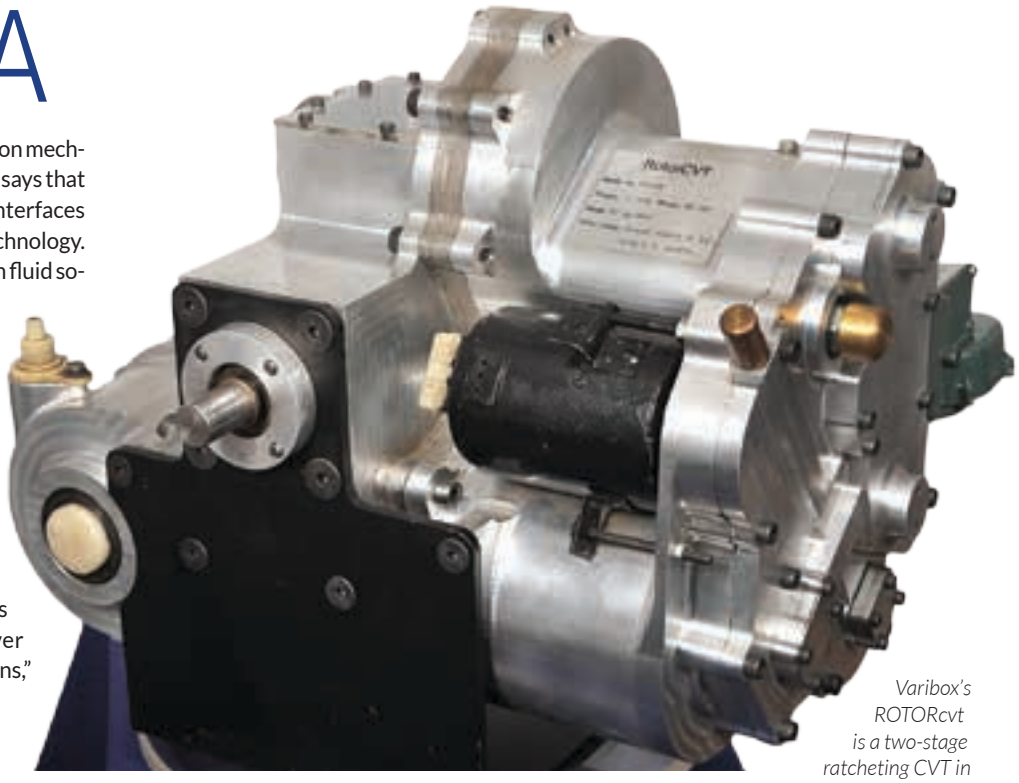
The use of auxiliary hydraulic clamping and control systems and the friction interfaces both lead to losses. "Losses are usually evaluated at the maximum power point, which is a bit misleading," says Naude. "A 100 kW CVT might be 95% efficient when transferring 100 kW, but if only transferring 20 kW, its efficiency is much less. On average, across the normal load profile for a pulley-based CVT, an 85% transfer efficiency is typical. Running a hydraulic pump off the drive absorbs a further 5% of the output power. So the accumulated losses can amount to 20% or more," he says.



Following a PCT patent search application last year, Varibox's RADIALcvt, received a clean search report in February 2017. All 12 unique claims were granted 100% unmodified.

born in SA

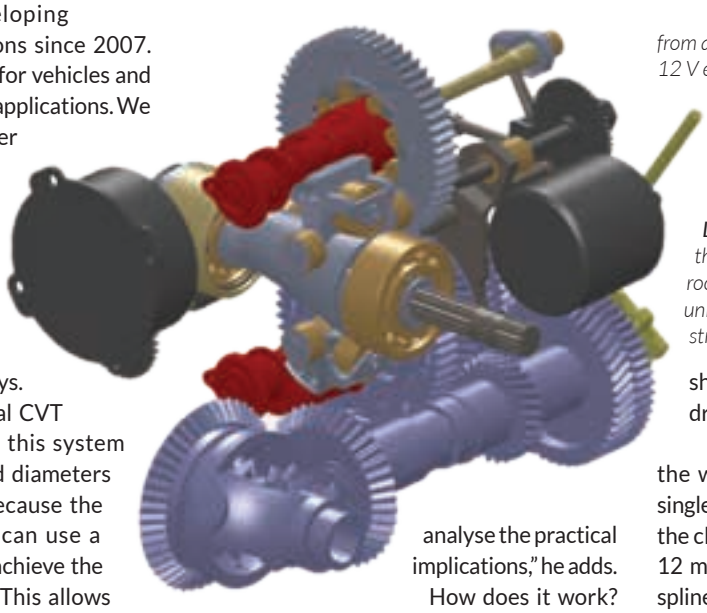
Further describing the transmission mechanism for pulley-based CVTs, Naude says that the traction stresses at the friction interfaces are another limiting factor of this technology. "At the microscopic level, the traction fluid solidifies at the steel-on-steel contact point, keeping the band or chain from directly contacting the pulley. But because all of the traction power has to pass through these two friction points in series, the contact pressures are very high. The highest currently possible is about 4.5 GPa, but this requires high-strength steel and operates at high temperatures. Reducing this contact stress is another key driver that underpins our alternative designs," he informs *MechChem Africa*.



Varibox's ROTORcvt is a two-stage ratcheting CVT in which the ratio adjustment from a geared neutral is done via a 350 Watt 12 V electrical system. The prototype has been implemented in a small passenger vehicle and fuel consumption and mechanical efficiency proved comparable to that of the manual transmission version.

Varibox solutions

Jan Naude has been developing alterative CVT configurations since 2007. "We focus on transmissions for vehicles and for variable speed industrial applications. We generally start with low power options for small passenger vehicles and then we strive to scale them up. To date we have developed three different CVT products: the icvt (incremental); the ROTORcvt; and, most recently, the RADIALcvt," he says.



Left: *The ROTORcvt has rotor follower units that operate rocker arms via their rollers. The rocker arms take turns to drive the output gear units using a ratcheting principle driven by the strokes of the rotor follower units.*

Describing the new radial CVT configuration, he says that this system uses three rollers with fixed diameters as the input drivers and, because the diameter is constant, "we can use a constant clamping force to achieve the necessary traction friction. This allows us to use mechanical springs for clamping instead of hydraulics, which removes complexity, expense and weight."

In addition, the input power is divided into six parallel power paths – three rollers are used to drive two disks in opposite directions – on a common friction drive interface. "This allows the metal-on-metal contact stress in each friction drive to be kept below 2.0 GPa, thus avoiding having to use expensive materials," he notes.

"In addition, with our icvt and ROTORcvt designs, although also unique, we have found it difficult to get acceptance from the automotive market because they use totally new concepts and principles. With the RADIALcvt, we have used existing parts, technologies and principles in a new configuration, making it easier for automotive OEMs to visualise and analyse the practical implications," he adds.

How does it work?

At its starting point the Varibox RADIALcvt uses a shaft from the engine to drive a bevel gear. This is connected to three splined radial shafts that turn the three rollers that are 120° apart.

"The rollers are clamped between two large driven disks, which rotate in opposite directions. The output drive is recombined by changing the direction of the one disk and then coupling the transmission pathways through a differential planetary system to the output shaft," Naude explains.

Describing how the speed is varied, he says: "The key principle is that the disks are slightly conical (6.5°), the one being convex and the other being concave. So by moving the roller mounting structure in the direction of the input shaft, the radial drive rollers are forced to move up or down their splined shafts, changing the drive radius on the driven disks.

The adjustment is achieved by rotating the whole roller mounting structure on a single lead screw. This moves the alignment of the clamped discs through a range of around 12 mm relative to the position of the fixed splines, which causes the position of the three drive rollers to move closer or further away from the axis of rotation of the clamped disks.

"The screw mechanism is driven by a 100 W electric motor, which guides the clamped structure along a set of three spiral ramps around the casing. We use simple 12 V pulse width modulation-controlled (PWM) motors similar to those used for windscreen wiper speed control. This is very economical and very easy to interface with modern CAN Bus vehicle control software systems," Naude notes.

The whole RADIALcvt system is very narrow and it can comfortably be mounted in front of the flywheel of any small car. The prototype system has been designed for cars below 50 kW. "Current automatic transmissions for these vehicles include the traditional automatic fluid transmission, which is both

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expensive and inefficient; the automated manual transmission (AMT) with and automatic clutch and gearshift mechanism; or one of the pulley-based CVTs from Bosch or LUK, which is heavy and expensive," Naude notes.

Compared to the range of options available in existing small cars such as the Honda Jazz; the Kia Picanto, the Chevrolet Spark and the Cherry QQ3, Naude says that the RADIALcvt is, typically, much smaller. "It fits the design space and provides a much cheaper automatic option for the small car market," he says.

He notes that low-cost passenger vehicles start at R100 000 with the first automatic options being significantly more expensive at R158 000. "There are only 4 and 5 speed fluid transmissions available at between R158 000 and R196 000 and the fuel consumption of these is substantially worse than the cheaper manual versions. The lowest priced vehicle with a CVT, according to the March 2017 issue of *CAR Magazine*, is priced at R233 000.

"This clearly demonstrates the market opportunity for a low-cost, CVT-driven vehicle with fuel consumption comparable to that of a manual.

Our business model is to invent and patent new CVT principles and technologies where the patents are strong. If a claim is not strong, then it is not usually worth going through the patent process and expense. I do my own patent searches before starting to design a concept. Then I follow the PCT application process, which, after three months or so, returns its findings in the form of a formal PCT search report as to whether the invention is new and unique enough to create a robust patent. This is a single point of application for a patent that saves having to do separate searches in every country in the world," Naude explains.

"For the RADIALcvt, we began the application process last year and we received a clean search report in February 2017. All 12 unique claims were granted – 100% unmodified," he tells *MechChem Africa*. "By taking away the need for hydraulic pumps, splitting the transmission path into six and limiting the number of friction drives in series to one, our RADIALcvt will be able to achieve efficiency improvements of around 10%, at a cost that is comparable to that of an equivalent automated manual transmission (AMT), but with significant space and weight savings," he concludes. ❑

RADIALcvt quick facts and advantages

- The input power is divided into six parallel power paths with each path encountering only one friction drive interface in series.
- The metal-on-metal contact stress in the friction drive can be kept below 2.0 GPa, thus obviating the need for expensive materials.
- A constant input radius on the friction drive input enables a constant clamping force via springs to be used, reducing complexity. No hydraulic control system is required.
- A large radius variation on the friction drive output provides the ratio range.
- Ratio actuation is electric via a simple 12 V DC motor, controlled by pulse width modulation (PWM).
- A hard-geared (direct drive which bypasses the variable friction drive) first ratio is included to overcome the 'kerb test' issue common with push-belt CVTs.
- A concept design for a 40 kW front wheel drive vehicle (three-cylinder Chevrolet Spark, for example) is available to demonstrate compactness and suitability.
- The system is ideal for use in hybrid vehicles as the maindrive as well as the energy recovery device.
- The RADIALcvt is scalable.

A world of **reliable rotation**

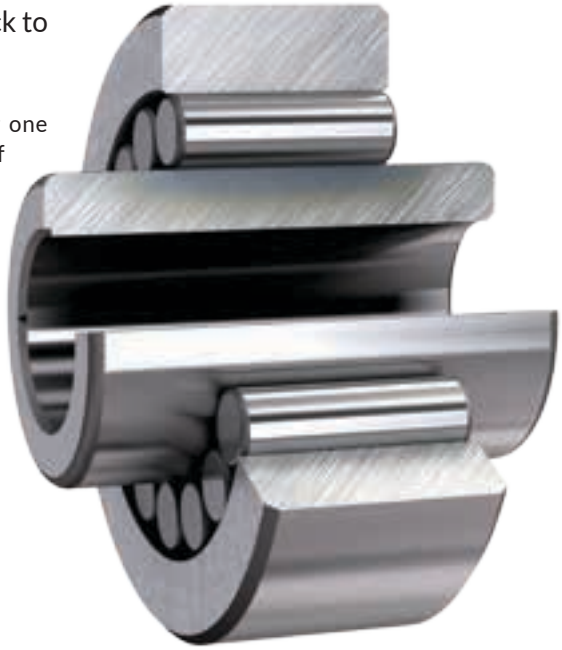
SKF has taken a strategic decision to shift its global business focus back to the company's core strength – bearings.

As a leading global technology provider since 1907, SKF has over the years developed a holistic product and service offering that is integral to bearing performance and reliability. "Since 2007, we have been placing our energy into seals, lubrication, power transmission, mechatronics, condition monitoring and engineering service solutions to support our quality bearing range, and this we have done with great success," says SKF services and solutions manager for southern Africa, Sarel Froneman. "But we may have been too successful, losing focus on what is fundamental to our rotating technology solutions, namely our bearings."

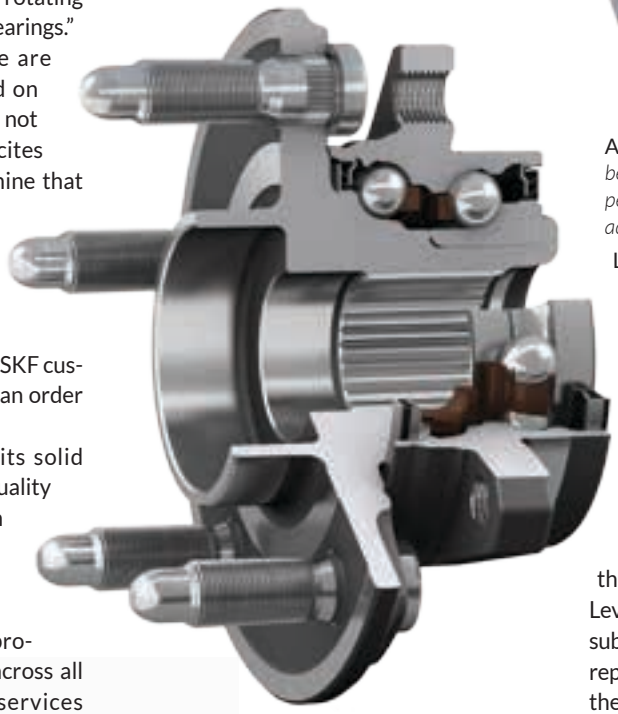
According to Froneman, there are customers who have standardised on SKF's products and systems that do not necessarily use SKF bearings. He cites one such example of a local coal mine that has standardised on SKF's condition monitoring systems yet their crushers, conveyors, electric motors, gearboxes, etc. may not necessarily be equipped with SKF bearings. "So while the mine is a key SKF customer, they may never have placed an order with SKF for our core product!"

While SKF continues to hold its solid reputation as a leading supplier of quality bearings, SKF CEO, Alrik Danielson believes that SKF must once again become the world's number one bearing company. "Our mandate is therefore to raise the profile of SKF bearings across all our product and services offerings," Froneman says. "Our bearing offering should remain our number one priority and common denominator of all our rotating technology products and services.

"This having been said, we must not lose sight of the fundamental role of our application engineering and asset management service solutions. SKF's application engineering is an integrated range of products designed to support the integrity of rotating machinery, the most critical components being bearings," he says.



Above: *Compact, lightweight rocker arm bearings from SKF support high rocker arm performance and reliability with several advanced features.*



Left: *SKF hub bearings are bearings are now being used to boost handling, comfort and the driving experience on the new Cadillac CT6.*

Froneman explains that application engineering usually deals with more complex requirements such as upgrades and customisations and may involve an investigation of the bearing, for example. In consultation with the customer, the application engineering team can develop a complete and optimal rotating technology solution with bearings at the core. The SKF application-engineering team's capabilities extend to modifications of standard products such as the manufacture of special sealing arrangement changes to bore-sizes on standard couplings, etc. Froneman adds that his team can also modify access ports for condition monitoring or lubrication services.

Bearing remanufacture is another key function of SKF's application engineering. "Our basic remanufacturing service can restore unused bearings that have passed their shelf life to 'as new' at approximately 15% of the cost of a replacement bearing. For bearings that have been in operation, we offer a full Level 4 remanufacturing service. Alongside substantial savings on cost compared to a new replacement unit, remanufacturing also offers the advantages of fast turnaround times and a reduced carbon footprint as less new steel is required."

SKF's asset management services embrace maintenance solutions based on asset criticality geared to minimise the risk of failure by optimising equipment reliability and subsequent equipment life for maximised uptime. This move underlines the new SKF Group vision – 'a world of reliable rotation' and demonstrates the company's understanding of what customers ultimately want – improved productivity and lowest possible ownership costs through reliable equipment performance and extended equipment life.

In conclusion, Froneman says that it is not about selling as many bearings as possible: "Bottom line, by adding value through offering holistic rotating technology and service solutions, we build long-term customer partnerships." ❑

X-Series IG units for Lesotho diamond mine

SEW-Eurodrive is continuing its involvement at a major diamond mine in Lesotho by supplying three complete power packs for use on the tailings side of the operation.

An initial order for supply of 20 power packs for tailings operation at a diamond in Lesotho was received in December 2014, with technical clarification in 2015 and delivery in February 2016. The latest order, for three additional power packs, was received in May 2016 and fulfilled in September 2016. Despite the differing lead times, SEW-Eurodrive's local stockholding and value-added service offering meant that the requirements of the two orders were met comfortably, comments head of projects Rudi Swanepoel.

Each power pack consists of an X-Series Industrial Gearbox with high- and low-speed couplings, motor and base plate. These pre-assembled units represent significant cost-savings and reduced downtime, as the power pack is supplied with the input-coupling shaft with the alignment already carried out. Combined with the above-mentioned shaft alignment, in general there are only two interfaces that need to be fitted. "If all the civils are done correctly, this is a major benefit for the client," Swanepoel comments.

The X-Series of versatile and powerful IG units from SEW-Eurodrive provides an ideal solution for conveyor belt drives, with a torque range from 6.8 kNm to 475 kNm. The range also features a large number of accessories to allow for maximum flexibility and a wide range of gear ratios for helical and bevel-helical gear units.

Nearly any mounting position or shaft arrangement on a driven machine can be implemented. A reversible gear unit housing also facilitates variable installation. The robust housing, low-noise gearing and cooling system boost safety and ease of maintenance.

The Lesotho contract represents a significant extension of the OEM's footprint in the Southern African mining industry, points out Mario Sicchiero, head of exports at SEW-Eurodrive. "The downturn in the mining industry globally has meant a reduction in the number of Greenfield projects, which has resulted in us nurturing those key client relationships in order to maintain our ongoing success in securing new work," Sicchiero stresses. "However, the general consensus is that commodity prices have bottomed out, which means that major mining houses will start to invest again once these green shoots become visible," he adds. ❑

Unidrive and Central Edible Oils celebrate 30-year relationship

Credible and quality management, integrated with trust and impeccable safety standards are some of the basic requirements needed to maintain a 30-year supply and service contract between Central Edible Oils, known as CEOCO and Unidrive Electric Motors Company. This relationship which has been beneficial for both parties, continues its prosperity as a new partnership contract has been concluded, which will result in Unidrive continuing to be a supplier of choice for new electric motor sales and maintenance.

"Unidrive has been our supplier of choice for as long as I have been working here in 1989, and that is because of their ability to constantly deliver on our requirements. Unidrive also adheres to and meets all our safety standards which is important for us as we expect all our suppliers to meet certain standards to be able to operate or supply our facilities," says Coenie Berowsky, CEOCO maintenance manager at the Boksburg plant.

CEOCO produces high quality crude sunflower oil for use in the manufacture of cooking oils, margarine, and other edible products and sunflower seeds cake which is used in the production of animal feed. CEOCO operates from the UNILEVER plant in Boksburg, and also supplies UNILEVER with crude oil to produce Flora and Rama margarine.

Berowsky adds that electric motors sourced from Unidrive are crucial in ensuring that the operations are functioning at all times on a 24-hours, 7-days-a-week cycle. The motors control all conveyor belts, taps, toasters and extractor drives throughout the Boksburg plant.

Unidrive motors are flame-proof and meet all the required safety certificates to be utilised in all CEOCO plants. "This is a very dangerous plant as the solvent we use is called Hexane which is very explosive. All the electrical equipment and motors we use in the plant must be flame-proof and must be registered," says Berowsky.

He says Unidrive is also reliable on the supply of new motors. "When I phone them requiring a new electric motor, they have quick turnaround in delivering that. You can call them anytime of the day or week requiring a service or supply of a new motor and you are definitely going to get a positive response,"

Theo Mashego, Unidrive Electric Motors' managing director says their partnership with CEOCO has been growing from strength to strength through the years because of close relations between the teams on both side. "After some many years of maintaining and supplying new equipment to CEOCO, we are like part of their family and have taken it upon ourselves to ensure that the company's operations experience minimum disruption. Our close working relationship which ensures that enquiries and service requests are attended to almost immediately upon receipt," he concludes. ❑

Unidrive MD Theo Mashego, CEOCO maintenance manager, Coenie Berowsky and Unidrive sales executive, Alfred Bibbey

Customised service kits for extended

intervals on specialised equipment

Fluid management specialists, Hytec Fluid Technology (HFT), a Hytec Group company, has moved into a new 2 800 m^2 facility in Spartan. *MechChem Africa* talks to HFT's general manager, Sandor Bottyan about the extended customised service kits offering that comes with the move.

HFT's general manager, Sandor Bottyan in the reception of the company's new 2 800 m^2 Spartan facility.

HFT's move into new and larger premises is a direct result of the growth experienced since introducing its service kits offering for mobile heavy vehicles. "Since partnering with Cummins Filtration and the Fleetguard brand back in 2015, we have been offering an ever-expanding range of customised service and filter kits," begins Bottyan. "This new facility is purpose designed to support that focus," he tells *MechChem Africa*.

"We see this as an ideal solution for fleet and equipment owners who are seeking to extend service intervals of their equipment and reduce cost of ownership. In partnership with Cummins Filtration and Fleetguard for example, we have had considerable field successes in extending service intervals and reducing the number of filter and oil changes required for our customers," he reveals.

An example of this offering can be seen in the adaptation of the conventional service regime of typical mining and construction machinery, where fuel and oil filters would be changed every 250, 500, 750 and 1 000 hours, with the air filters being changed at 500 and 1 000 hours intervals respectively.

"But with selected ESI (extended service interval) Fleetguard filters, the air, oil and fuel filters are all suitable to be changed every 1 000 hours, so an operator only uses half the air filters and one quarter of the oil and fuel filters compared to most OEM recommendations.

"Also key to the extended service interval programme is the engine oil service life, which needs to be in excess of 1 000 hours. This brings the life of all of the service kit components into line, so that a full service can be completed once every 1 000 hours, without having to do additional oil changes every 500 hours," he says, adding: "The result is less downtime for routine servicing and lower maintenance costs."

"We also make use of the Fleetguard OAT (organic acid technology) coolant as part of the package offering. This is a lifelong coolant, which when filled in an engine, will technically never be required to be drained and refilled. Conventional coolants are usually drained every 4 000 to 6 000 hours, up to 10 times more often compared to the Fleetguard OAT product," Bottyan continues.

The long-life product also enables the Fleetguard OAT coolant to be drained, filtered and reused during the lifecycle of the vehicle. "We are now routinely installing our HFT-designed coolant purification system to remove all solid contaminants, so that it can be safely reused in vehicles," Bottyan assures.

From its core competence in servicing off-road mining and construction vehicles that depend heavily on hydraulics, HFT is now growing its market share in the on-road haulage fleet market. "We have taken a collaborative approach with respect to the development of each kit. In partnership with fleet owners, vehicle OEMs, and our filter, lubricant and coolant suppliers, we determine the best combination of kit component to extend service intervals for on-highway fleets.

"In addition, we also offer training for the onsite technicians, which we feel is critical. It is only by adhering to the correct procedures and, most importantly, cleanliness levels that the full advantages of extended servicing intervals can be achieved," he tells *MechChem Africa*.

Depending on the environment, HFT also supplies oil and coolant dispensing and filtration equipment. "It doesn't help to only consider onboard filtration. We need to make sure that when fuel, oil or coolant is dispensed, this is as uncontaminated as it can possibly be. This is essential in extending service intervals," Bottyan continues.

Based on surveys of the fluid cleanliness levels being achieved onsite during servicing, HFT identifies bulk dewatering and filtration systems that could resolve contamination problems. "The use of pre-cleaners and offline filtration units are often very cost effective in overcoming fluid contamination issues during servicing," he notes, adding: "Transfer systems that prevent lubricants or coolants contaminant ingress from the external environment also help."

Together with customer selected third party laboratory companies such as Wearcheck Africa, HFT also offers oil analysis services to verify the cleanliness of the fluids being used and the effectiveness of its offline filters and transfer systems.

HFT's service-kit offering is available for all vehicle brands. "Across Africa, we are seeing

HFT's service kits are 100% customised. "As well as all the filter units, lubricants and coolants, some customers also want V-belts and wipers and such like, so every one is different.

service

an increasing number of vehicle fleets from OEMs in India and China. The low fuel quality and poor contamination control systems have a negative impact on mobile fleets.

"We develop the kits for these vehicles in conjunction with the owners and operators so as to ensure maximum equipment lifecycle by minimising contamination ingress thereby raising levels of service excellence", Bottyan notes.

"The tracking of service kits is also an extremely important function of the successful and comprehensive service extension programme to our customers. We are now able to track the quantities and where the kits are going, which enables us to more accurately meet supply and logistics demands. In addition, we know exactly when a kit is used, so we can monitor and alert customers when their next service is due," he says.

Bottyan explains how this works: "Scanners are used to book out each kit, with a unique tracking code being associated with an exact data set that shows which specific machine the kit is for. We develop these kits and the data sets in cooperation with customers in order to minimise the risk of human error during servicing. Each kit is allocated to a specific vehicle and the tracking system monitors exactly where that kit is at any time and alerts operators and us as soon as it is used.

The new HFT laboratory enables customers to send oil samples in for analysis. "We produce reports, keep records and we can trend the results from mobile equipment or from any of our decontamination systems.

HFT's VUD Vacuum Dehydrators combine optimised heat, vacuum, process and user-friendly operating systems for the removal of water and particulate from hydraulic and high viscosity lubricating oils.

HFT also manufactures customised and specific, transfer and bulk filtration systems at its new Spartan facility. These are available for sale or for on site hire. "We also re-certify hydraulic accumulators with our automated testing station developed by our sister Hytec Group Company, Tectra Automation.

"While we are not the only company to offer service kits for mobile equipment, we believe we have come up with one of the best service offerings available. We have a comprehensive understanding of hydraulics, while our partners – Cummins Filtration through the Fleetguard brand – have over 50 years' experience in the design and manufacturing of diesel engine filtration.

"This enables us to deliver the best-possible customised servicing and onboard vehicle contamination protection offering," Bottyan concludes. ❑

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Ingersoll Rand® products range from complete compressed air and gas systems and services, to power tools, material handling, and fluid management systems. The diverse and innovative products, services and solutions are produced with the intention of improving energy efficiency, productivity and operations for its customers.

At ComVac 2017 later this month in Hannover, Germany, Ingersoll Rand, considered a worldwide leader in compressed air and gas systems and services, will be revealing "breakthrough compressed air technologies that advance energy efficiency and performance of manufacturing operations for industries." The company will also debut its new Ingersoll Rand CARE Suite service offerings. This suite is a very comprehensive service and maintenance offering that increases reliability and reduces total costs of ownership for a plant's valuable compressor assets.

"Industries are looking for ways to increase reliability and reduce energy use, as pressure mounts on regulatory compliance, cost-efficiency and meeting customer demands. High-quality reliable air and gas compression helps these industries increase their profitability and competitiveness," says Eric Seidel, vice president of product management for compression technologies and services at Ingersoll Rand. "Compressed air equipment can last for decades and our service suite of offerings is suited to help customers improve uptime and reach their reliability and energy use goals, year-after-year."

Ingersoll Rand will unveil the Next Generation R-Series RS200 to RS250 oil-flooded, rotary screw compressors for the first time at Hannover Messe. Every Next Generation R-Series compressor features an all-new, sophisticated air-end that is one of the most efficient available today. The company reports that the compressor delivers as much as 15% energy-efficiency improvements over the legacy products. The RS200 to RS250 fixed- and variable-speed models come standard with features that offer customers new levels of energy-efficiency that maximise uptime for high-capacity compressed air needs.

Ingersoll Rand's next generation RS200 to RS250 compressors feature new air-ends that deliver as much as 15% energy-efficiency improvements over the company's legacy products.

Also on show will be the new, Subfreezing dryer (SFD), which is the only refrigerated air dryer on the market that can cool and dry air to a sub-freezing dew point (–20 °C).

Also on show will be Ingersoll Rand's new, 'breakthrough' refrigerated dryer technology, which is able to achieve a dew point of –20 °C. The Subfreezing air dryer is the only refrigerated dryer on the market that can cool and dry air to a sub-freezing dew point. The dryer is energy-efficient, compatible with oil-free and oil-flooded compressors, and has low maintenance requirements.

Ingersoll Rand will share its own new 'total systems' approach for maintaining the highest levels of reliability and efficiency. At the CARE Clinic on Ingersoll Rand's stand, an interactive event will take place, and experts will prescribe the correct services programme for customers, based on their facilities' specific needs.

In addition to maintenance services, Ingersoll Rand will showcase its refreshed rental programme, now with double the assets. All of the equipment is bolstered with durable components to provide the highest levels of reliability for a variety of applications. With eight locations and 146 assets across Europe, Ingersoll Rand is committed to ensuring its customers are up-and-running within 24 hours of a breakdown.

A number of experts representing many Ingersoll Rand product categories, including centrifugal compressors, rotary screw compressors, compressed air treatment and services, will be available at the show. ❑

ComVac 2017: Hanover Messe: April 24-28

ComVac, the leading trade fair for compressed and vacuum technology, takes place in Hannover later this month.

Manufacturers of compressors and vacuum pumps tend to be one-stop providers of a whole range of services, which is why ComVac is such a broad-based show, spanning all aspects of vacuum and compressed-air technology from systems for generating, treating and distributing compressed and vacuum air, to applications for using it in production plant and machinery, right through to contracting offerings and services. More than 200 exhibitors are expected to host around 28 000 visitors during the five day show. ❑

SA sole distributor for Dabeb-Elram

The Hytec Group was recently appointed as sole distributor of the Dabeb-Elram range of electro-hydraulic actuators, enabling the Group to use its distribution network to take Dabeb-Elram's DEA range of electro-hydraulic actuators to the doorstep of sub-Saharan Africa's major operations.

Stuart Palmer of Dabeb-Engineering, Freddie Kühn of Hytec and Nathan Pearce executive director of Dabeb-Engineering with a model of the DEA range of electro-hydraulic actuators.

Established over 48 years ago in Dalesside, Johannesburg, Dabeb-Elram specialises in the manufacture of electro-hydraulic actuators that can be found in the majority of South Africa's power stations and refineries, as well as in major mining operations around the world.

With the DEA range, all actuator components, including the cylinder, motor, pump, pipework and valves, are enclosed in a self-contained steel casing. "This creates many benefits for our clients," says Nathan Pearce, executive director of Dabeb-Engineering. "As these are sealed units, they are protected from external contaminants and tampering, while their robust steel casings make them ideal for the harshest operating environments."

This 'plug-and-play' functionality also effectively reduces the requirement for client commissioning time and, in addition, its compact design enables a closer-mounting solution to almost any linear application. The DEA range also features a pressure relief and flow control valve that enables versatile and flexible performance in terms of speed and force.

All Dabeb-Elram electro-hydraulic actuators are manufactured at the company's 1 500 m^2 facility on a case-by-case basis, according to clients' unique specifications. Dabeb-Elram also offers full repair and refurbishment of its electro-hydraulic actuators, no matter the age or condition.

"As Dabeb-Elram is one of the country's leading suppliers of electro-hydraulic actuators, whose sole focus is on the development, manufacture and supply of this particular product range, our clients benefit from the highest quality product that is backed by nearly 50 years of in-field application knowledge and experience," comments Hytec regional manager, Freddie Kühn. "And as a true testament to the longevity of both its brand and product, Dabeb-Elram has relied on the product's self endorsement for the past 48 years."

Speaking on the decision to partner with the Hytec Group, Pearce says: "Not only is the Hytec Group Africa's largest hydraulics company, it is well-positioned to grow in sub-Saharan Africa and our companies are aligned in our commitment to sourcing highest-quality products and to finding solutions to any application."

The Dabeb-Elram range of DEA electro-hydraulic actuators is now available with a one-year warranty through the Hytec Group's network of 35 branches throughout sub-Saharan Africa. ❑

HyperWorks 2017: the comprehensive

In March 2017, Altair released HyperWorks 2017: The Comprehensive Platform for Simulation and Innovation, with added functionality for open architecture CAE software platforms.

With its release of HyperWorks 2017®, Altair can offer new best-in-class technologies to design and optimise high-performance, efficient and innovative products. This latest release sees several functionalities added in areas such as model-based development, electromagnetism, nonlinear structural analysis, modelling and meshing, multi-physics and multi-disciplinary analysis, lightweight design and optimisation. New products and enhancement highlights include:

Model-based Development Suite: solidThinking Activate®, Compose® and Embed® capabilities encompassing concept studies, control design, system performance optimisation and controller implementation and testing are now part of the platform.

Electromagnetics Analysis and Design: Flux™ for EM simulation of static and low frequency applications, and WinProp™ for propagation modelling and radio network planning are added as perfect complements to FEKO, focused on high frequency EM simulations related to antenna design, placement, radiation hazard, bio electromagnetic.

Material Modelling and Manufacturing: Multiscale Designer is a tool for development and simulation of accurate models for heterogeneous material systems including laminated composites, honeycomb cores, reinforced concrete, soil, bones, and various other applications. Manufacturing offerings now include solidThinking *'Click2'* products for extrusion, casting and metal forming process simulation.

Usability and Efficient Model Management: HyperMesh® now offers a complete, robust solution for assembly and model variants management, expanding the part library and configuration management capabilities. Important new features for crash and safety users have also been implemented. A brand new desktop tool called ConnectMe™ has been developed to efficiently manage, launch and update all the products within the HyperWorks suite.

"HyperWorks 2017 adds key enhancements to the modelling and assembly capabilities of the software," says James Dagg, chief technical officer, user experience at Altair. "Users can now communicate directly with their enterprise PLM system, storing libraries of parts and configurations of their models. Tasks like setting up a model with multiple configurations for different disciplines can now be done in minutes."

Multiphysics Analysis and Performance: Major speed and scalability improvements have been implemented for all the Altair solvers. In particular, structural analysis capabilities for OptiStruct® have been further elevated to support the most complex nonlinear contact and material models. For fluid simulation (CFD), new turbulence and transition models have been implemented in AcuSolve to capture laminar to turbulent flow regime change.

In terms of computational performance, FEKO, OptiStruct, and RADIOSS leverage the most modern computer architectures and latest parallelisation technology to generate solutions faster and make them more scalable on compute clusters.

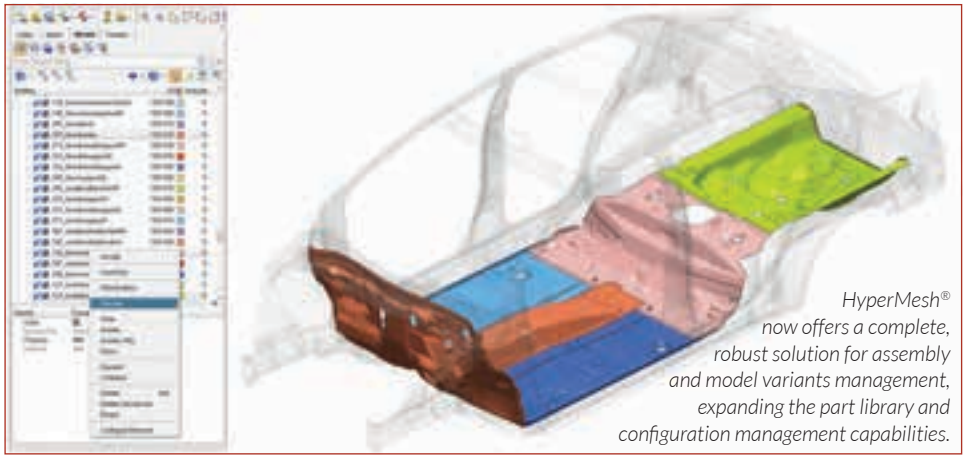
"With the HyperWorks 2017 release we followed our vision to continue focusing on simulation-driven innovation. We are now able to simulate more physics with improved high-performance computing (HPC)," says Uwe Schramm, chief technical officer, solvers and optimisation at Altair. "In particular, with the addition of Flux for low-frequency EM simulation, we're offering a complete multi-physics portfolio all linked through optimisation."

Simulation driven design on show in Hannover

Altair is to present HyperWorks 2017 at this year's Hannover Messe, along with its solutions and methods for simulation-driven design and a technology demonstrator of a virtual cobot (a collaborative robot), as well as customer examples to demonstrate how Altair's solutions can be applied to develop innovative products.

In addition, Altair will host: a "Design the Difference™" day, offering a conference programme that addresses the challenges and needs of engineers working on the development of increasingly complex products, featuring customer examples of successful product developments. The *Design the Difference* conference programme is included in the overall program of the CAE Forum and will take place on April 25th.

Today, product creators have to consider the entire mechatronic system, including its structure, sensors, actuators, controllers and much more. How these complex processes can be handled will be presented with a virtual cobot demonstrator, showing the challenges in the development of smart devices and offering solutions for innovative IoT products. From 1D to 3D; from sensors to optimised structures; as well as data analytics: these all required development steps that can be conducted and solved with Altair's software platform and its simulation-driven approach.



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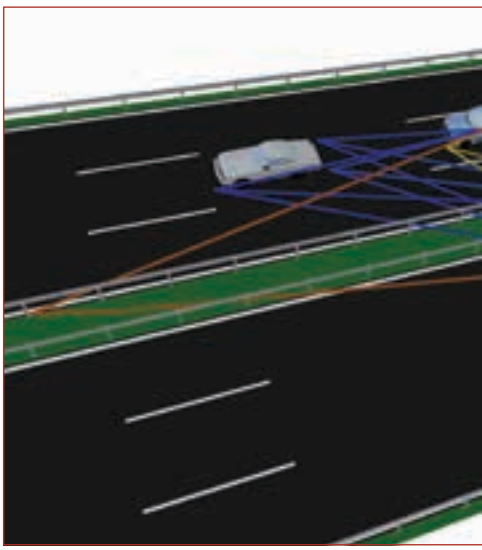
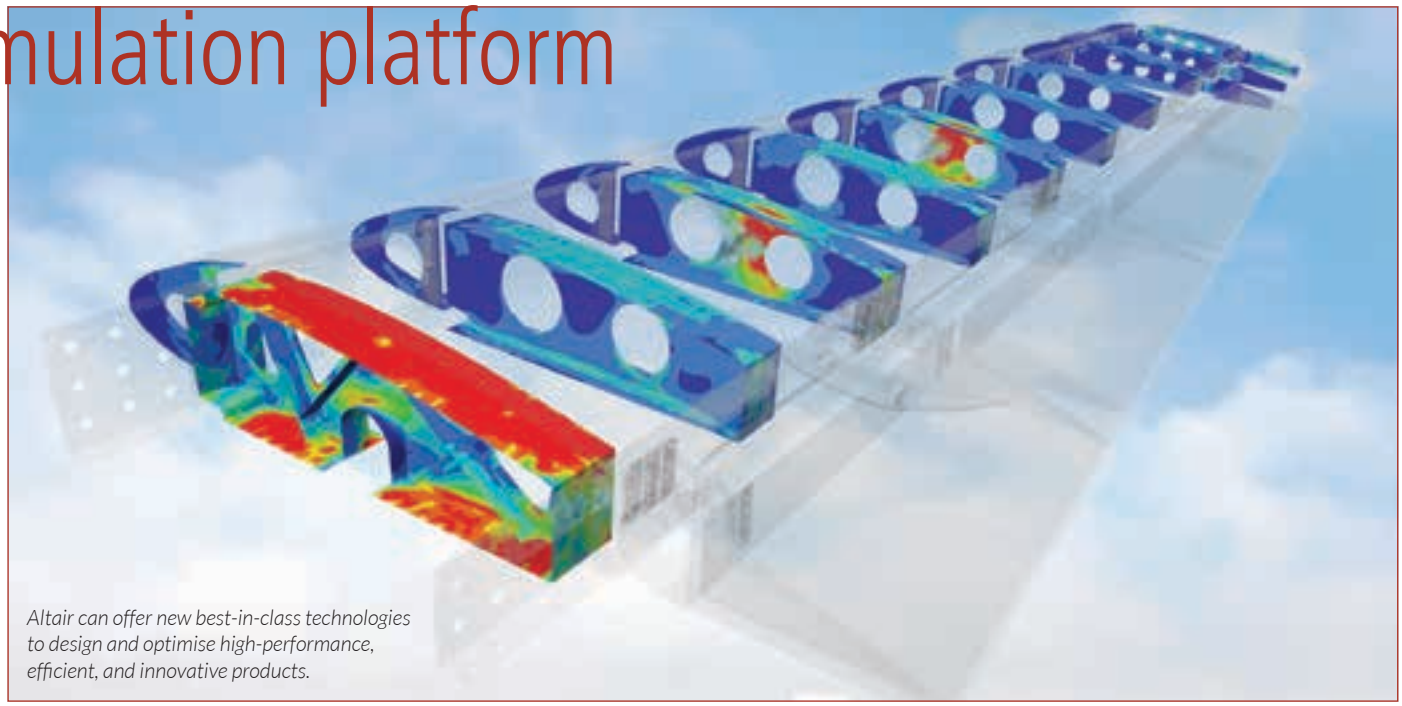


simulation platform



Altair can offer new best-in-class technologies to design and optimise high-performance, efficient, and innovative products.

How to handle manufacturing methods and smart materials are being showcased with exhibits of products by Altair customers. Among these the Robot Bike, a bike that combines carbon fibre and 3D printing technologies, resulting in a fully customisable, lightweight, and high strength mountain bike; PROTIQ's additively manufactured injection moulding tool, that offers unparalleled profitability through structural and thermal optimisation; and an example of a before welded component of a rocker arm for an agricultural soil tillage unit from AMAZONE, which is now caste having been optimised with respect to weight, material usage and durability.

Highlighted topics at the Altair stand include:

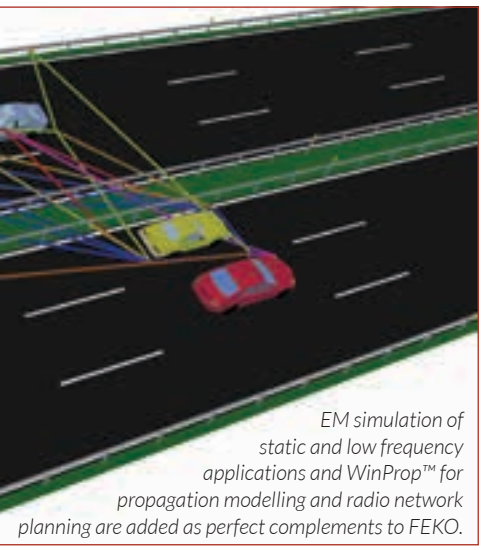
- Design processes for modern manufacturing methods.
- Electric efficiency.
- Smart material design.
- Connected model based engineering.
- System simulation.
- Industry 4.0, Cobots, Smart devices and the IoT.
- HyperWorks 2017, the most comprehensive CAE platform available today.

In addition, Altair is pleased welcome Laser Zentrum Nord GmbH as a co-exhibitor at this year's conference. Together the two companies will present their specific solutions for additive manufacturing, a collaboratively developed Design for *Additive Manufacturing* training programme as well as a joint case study of a bionic brake pedal.

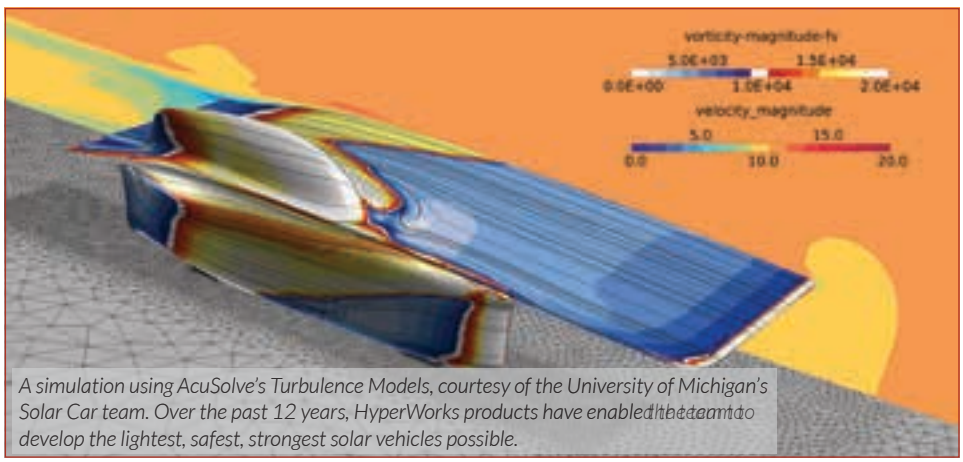
"We are happy to welcome Laser Zentrum Nord at our booth," said Mirko Bromberger, director of marketing and additive manufacturing strategies at Altair Engineering. "The company is an important ally for us, especially with regards to new development and manufacturing processes, such as additive manufacturing. Visitors to Hannover Messe can expect a very broad and informative program, highlighting solutions for various production and engineering disciplines, smart materials, Industry 4.0 and much more."

Says, Frank Beckmann at Laser Zentrum Nord GmbH. "At our demo station at the Altair booth we will focus on our innovative technologies for metal additive manufacturing and will be showing, amongst other components, a 3D printed bionic brake pedal demonstrator, which was optimised using the Altair tools and manufactured following the processes we recommend for more efficiency in metal 3D printing. The structure of this demonstrator was optimised with the aid of topology optimisation against the background of light construction. The design was adapted for additive production in order to keep the number of support structures as low as possible. As a result, the need for after-treatment of the pedal is reduced to a minimum."

The agenda of Altair's Design the Difference programme covers the challenging journey engineers have to make when developing for Industry 4.0 and presents solutions and methods for simulation driven innovation by illustrating various industry examples on how to develop innovative products successfully, despite an increasing complexity. ❑



EM simulation of static and low frequency applications and WinProp™ for propagation modelling and radio network planning are added as perfect complements to FEKO.



A simulation using AcuSolve's Turbulence Models, courtesy of the University of Michigan's Solar Car team. Over the past 12 years, HyperWorks products have enabled the team to develop the lightest, safest, strongest solar vehicles possible.

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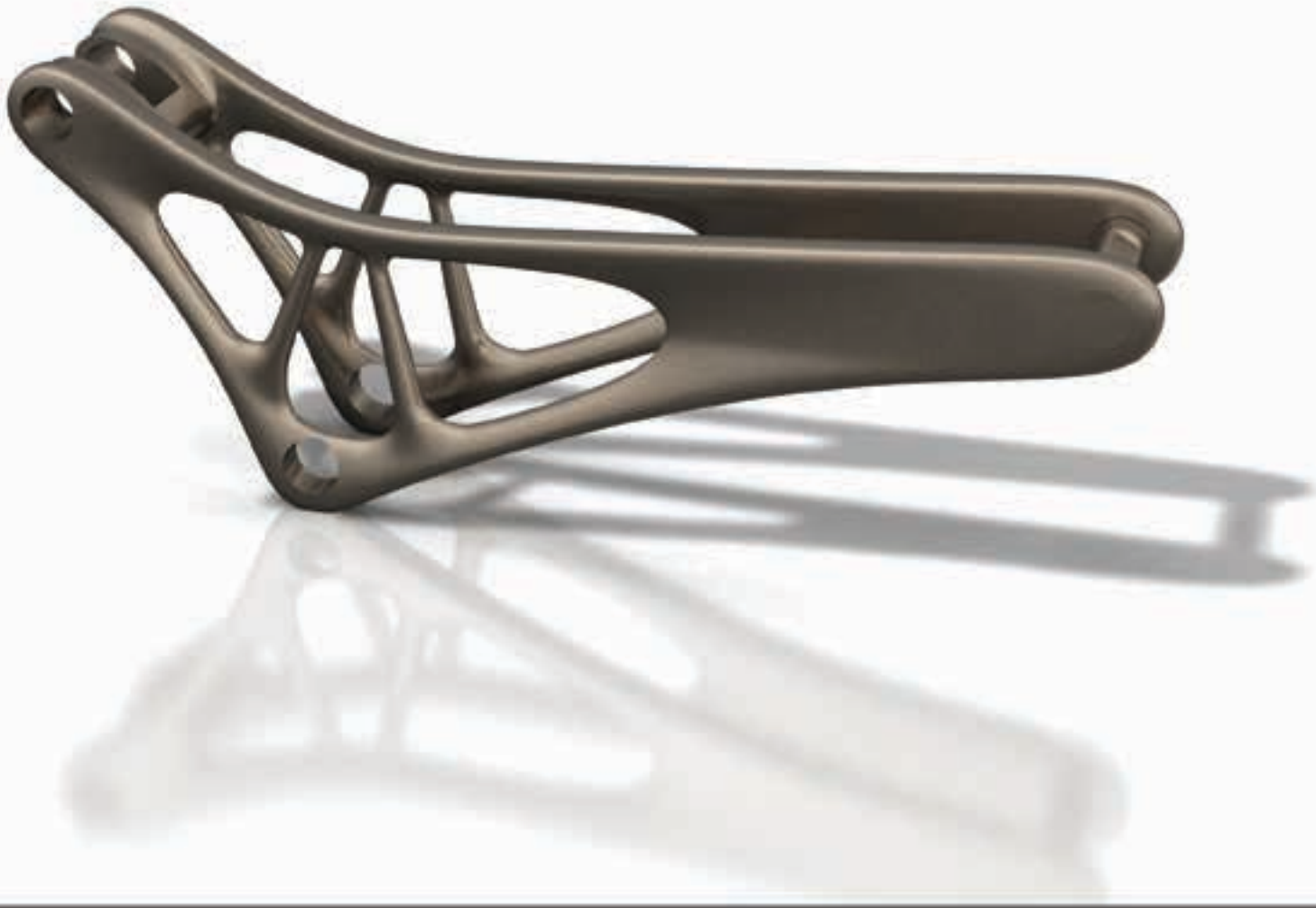

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Partnering effectively using smart numbering

A smart numbering system used by FLSmidth Roymec allows for a seamless process with integral capability to handle revisions. This sophisticated proprietary software programme facilitates absolute control of all elements of the conveyor build and has already realised significant savings on projects, an important factor in all construction activities.

Conveyors are the arteries of any bulk materials handling system. Irrespective of whether undertaking new conveyor construction or upgrades, it is not only necessary to have access to in-depth engineering and design knowledge, it is critical to be able to execute a project no matter how remote the location.

With its customer-centric approach, FLSmidth Roymec has a strong background in structural engineering, fabrication and successful project implementation for conveyor systems. The company's major differentiator is its use of a sophisticated proprietary software programme, which facilitates absolute control of all elements of the conveyor build. This innovative approach to managing project logistics has realised significant savings, which is an important factor in all construction activities.

Patrick Smith, manager for scoping and business improvements for FLSmidth's South African operation, says that while many companies have the capability to fabricate conveyor structures and supply ancillary components for conveyor systems, none has access to this type of sophisticated process control.

"Being fully aware of the need to optimise project schedules and still retain absolute control of all aspects of a project, FLSmidth made a significant investment in developing this resource," Smith says.

"It allows us to partner effectively with customers from concept to completion and access information whenever needed, allowing an active responsive interface with all throughout the entire process. This allows significant productivity increases with associated cost reductions."

The FLSmidth smart numbering system uses the source information from the initial design through to the end of the project. Smith explains that it is a seamless process with integral capability to handle revisions. There is no manual input required and tracking continues through design, in-house detailing, fabrication, galvanising, painting, trial assemblies (where relevant) and through all logistics functions to final on-site installation.

"Each project is controlled from the design phase where the smart number is conceived and this makes it easier to control the flow of materials to site," Smith says.

Jaco van der Westhuizen, senior developer, at FLSmidth's South African operation, has overseen the software design and implementation of the FLSmidth system using an API interface to the Tekla drawing data. This allows the information to be made visible to all and facilitates the tracking process.

A typical FLSmidth conveyor transfer point. Access to sophisticated process control such as its smart numbering system enables FLSmidth's South Africa to fabricate quality conveyor structures and supply ancillary components on time, in sequence and at the lowest cost.

"The software stores all the information from the Tekla models in one single database allowing easy access at any stage. This is an important advantage as it allows everyone involved in the project to access and mine the information using the API interface," van der Westhuizen says.

The FLSmidth smart numbering system is always the same. It is a hard stamp number that is simple to read. FLSmidth's people can easily understand its numeric hierarchical structure and this facilitates tracking of all elements of the project as well as easy location of different fabricated members on site and the erection thereof.

Significantly, it eliminates double handling and the site teams have been trained to recognise the number. This enables the FLSmidth teams to deliver a quality product on time and in sequence, at the lowest cost. ❑

Industry 4.0: A world of new business models and markets

On April 4, 2017, Festo South Africa hosted a seminar at which its global Industry 4.0 campaign head, Eberhard Klotz demystified the concepts and introduced the key opportunities. *MechChem Africa* summarises his opening session.

Introducing Klotz at the start of the seminar, Festo South Africa's Russell Schwultz says that, while Industry 4.0 is much spoken about: "It doesn't seem real yet. In South Africa, we need to demystify the concepts and make them more practical.

"Globally, unlike many other companies, Festo is able to back the rhetoric with products. Industry 4.0 is something we believe in, we are investing in it and proving the principles in practice in our own factories," he reveals, adding that the purpose of the day is to "declutter and demystify" the technology by introducing things that are happening right now, "things that are sure to affect us in the future".

Klotz introduces Industry 4.0 as the starting point for many changes. His opening slide reads: *'Industry 4.0 describes the fundamental change to value creation chains and the life-cycle of products, where the real and virtual world grow together.'*

"Currently, one big disadvantage is that there are no precise definitions for Industry 4.0," he continues. "We tend to draw a broad picture regarding the networking of components, machines and factories. But there are different terms being used to describe this: the Internet of Things (IoT) and SmartFactory, for example.

"In Germany, though, where the Industry 4.0 term was first used, we use it to refer to the change in production and manufacturing techniques that become possible because of the power of modern communication networks," he explains.

"It's about networking of machines and components to enable modifications and changes to be made to production systems. This is the focus from a production point of view," he reiterates, "it's about the use of networking to better manage our production processes."

Related to this is the better use of digital platforms and virtual world models of machines and components. By understanding machines and processes via 3D virtual models and simulations and using these platforms for advanced digital planning, it becomes possible to better align the real and the ideal.

"The performance of the digital representations of factories, machines and components can be compared to those achieved in the real-world systems, allowing us to optimise our designs, implement better production techniques, reduce waste, make better use of energy, track reliability and improve preventative maintenance concepts," Klotz explains.

Why is Festo interested in this topic? "In our own production systems, we manufacture thousands of products and a huge variety of them. In addition, many Festo customers require customisations to suit their particular needs, and these must be accommodated in short lead times. To do this, we need production equipment capable of making customised goods in small batch sizes in an efficient and cost-effective way," he explains.

Festo also offers a very wide range of electrical and pneumatic solutions and components for factory and process automation applications. "Our customers also face challenges to improve their productivity and effectiveness, so Festo has a vested interest in developing connected components and machines capable of delivering Industry 4.0 advantages," Klotz says.

In Germany, he continues, "Industry 4.0 is a strategic initiative driven by the government with the aim of optimising production across the country. Festo is one out of four industry speakers on the Industry 4.0 steering board, which also includes SAP, Siemens and Deutsche Telekom's T-Mobile." These four companies are responsible for identifying the most effective technologies for the practical aspects of Industry 4.0: enterprise and manufacturing management systems and big data analytics; the electronics, control systems and software; the communication and connectivity; and the physical actuation devices.

Together with working groups, universities and research teams, Germany has developed a long-term roadmap for Industry 4.0 covering the next 20 years, covering the short-term priorities and the long term goals. "Over the next two or three years, standardisation with respect to communication protocols, CAD, visualisation and simulation platforms have been identified," Klotz explains.

International developments

"Industry 4.0 is a small part of a broader picture, which includes connected cars, healthcare monitoring, energy systems management and public initiatives such as smart cities – all made possible via the Internet of Things. All of these new technologies are likely to be using the Internet as the backbone.

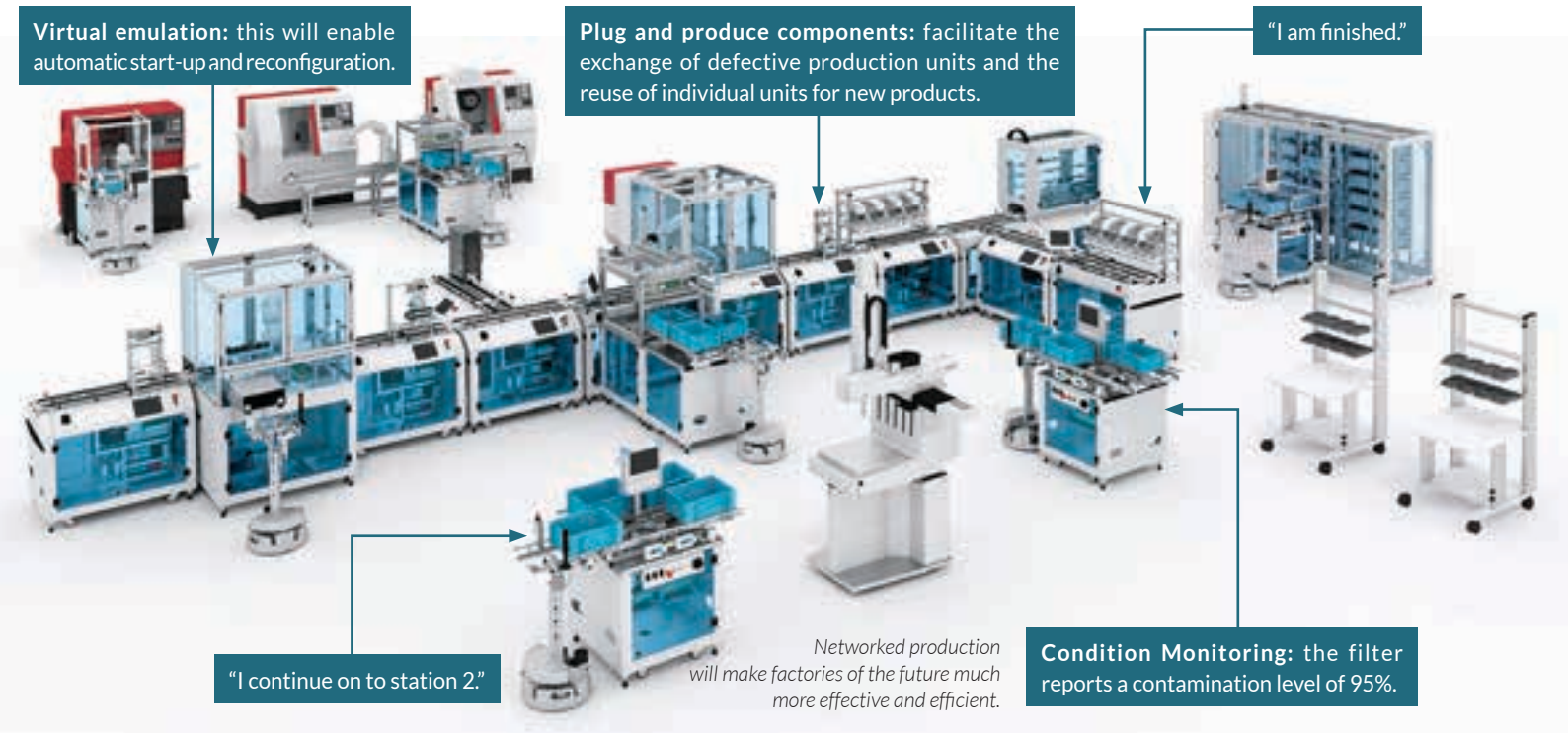
"We are seeing a number of German federations and associations cooperating to make Industry 4.0 happen, starting with standardisation and pilot projects to demonstrate practical implementation. The key challenge is to structure information so that all companies can take a direction that maximises synergy possibilities.

"Our perspective is that the technology is likely to get stuck if we miss the opportunity to standardise. If you buy one component from Festo and another from elsewhere, it is important that they can easily be made to work together," he continues. Klotz compares this to the success of USB technology, which enables a host of different devices to be interoperable with an unlimited number of peripheral devices. Any device you plug in downloads its driver automatically and is communicating within minutes.

"In the USA, a slightly different approach has been taken. They are more pragmatic, involve collaboration between innovators, who develop and test systems very rapidly and, if they work, these are immediately deployed. But is there conflict?" he asks.

"In the US, they are further ahead with respect to Internet-based communication, while in Europe, we focus more on horizontal and vertical networking inside the machines of production. We see the two approaches as supporting each other rather than being in conflict," suggests Klotz.

The Chinese government has also instigated a parallel strategic initiative called China 2025, which has similar goals to our Industry 4.0 initiative. "We know that the Chinese adapt and learn fast, so they are already chal-



Networked production will make factories of the future much more effective and efficient.

lenging our pace and ideas. So getting started is becoming an imperative," he adds.

Opportunities presented by Industry 4.0

Industry 4.0 approaches are being implemented in practice in all cases where networking will lead to better control, organisation and efficiency, but a clear customer benefit must first be identified. "This is critical," says Klotz. "There must be a tangible benefit to the customer, otherwise, their is no point in investing in these systems," he argues, adding: "We see five possible areas where Industry 4.0 could deliver customer value.

Production will become flexible with 'plug & produce' capabilities for minimum lot sizes at competitive prices. "In the car industry, for example, more and more people have individual needs and preferences. This is also starting to happen in food and textiles. Even shoe companies can now offer personal modifications to suit personal tastes based in an online order.

For this to be possible, production systems are needed that are capable of making these individualised products directly from the online order instruction, ie, without the need for direct human input.

Engineering processes: "In the past we had mechanical engineering and electrical engineering using different design packages and data formats. The same applies to the programming of the PLC systems; data input had to be redone at every stage. We are clearly missing an opportunity to use a common platform for all of our pre-production engineering and simulations, so that we can convert data into the different platforms automatically. Over the next couple of years a German Automotive manufacturer will be trialling some options that could make this a reality," Klotz reveals.

Energy management: Increasing resource efficiency at component, machine and factor level is now demanded in order to reduce the effects of global warming. "Simply by collecting the right data and planning production to optimise energy use and time of use, significant savings can be achieved. Also by better sizing the production systems to actual requirements, we avoid over-engineering the machines, which makes them more energy efficient," he explains.

Logistical processes: Via accurate demand planning, production can be better matched to demand. "On the logistics side, we tend to prefer to overproduce. In the case of food, for example, this overproduction is often simply thrown away. By accessing better and more precise data – from social media, online marketing and industry networking systems – it becomes possible to better match production to what is likely to be needed and consumed. This allows buffer stocks to be reduced and waste avoided, adding sustainability," Klotz says.

Predictive Maintenance: Collecting accurate data can be used in condition monitoring systems to increasing machine availability. "This aspect goes to the heart of whether Industry 4.0 involves revolution or evolution. Certainly, we already do a lot of predictive maintenance, using sensors linked to PLCs with dedicated analysis and recording systems.

"But there are no standards, and it is therefore expensive. Industry 4.0 aims to revolutionise the communication aspects of monitoring systems. As soon as one adopts web standards, the information can much more easily be accessed using our consumer communication devices – phones and tablets, for example. The tools become more accessible and big data analytics can be widely applied to individually connected machines. Predictive maintenance will become cheaper and much easier to implement," he explains.

On display at the seminar is a Festo Didactic system demonstrating the flexible manufacturing opportunities already on offer.

Much of the individual aspects of Industry 4.0 are already available as islands of relatively expensive technology. "The technology itself is nothing new. But the communication and networking technology is revolutionising the way our technologies will be deployed," Klotz says in concluding his first session. ❑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Smart process gating: muting reinvented

Leuze has recently developed a new compact, space saving design for smart process gating (SPG), which enables the bridging of a protective field without additional muting sensors. The SPG system, supplied locally and across sub-Saharan Africa by Countapulse Controls, also reduces installation and service costs.

Gerry Bryant, managing director of Countapulse Controls, says that the new Leuze safety system offers high reliability and availability, since there are no risks of misaligned or damaged muting sensors. Installation and service costs are lower because there is no set-up or alignment of muting sensors and even interrupted parts and pallets with gaps between loading can be safely transported in sequence.

"There is also reduced risk of tampering by operators," Bryant says. "Leuze has developed the SPG on the basis of the Type 4 safety light curtains in the MLC 500 series, so muting sensors are no longer needed."

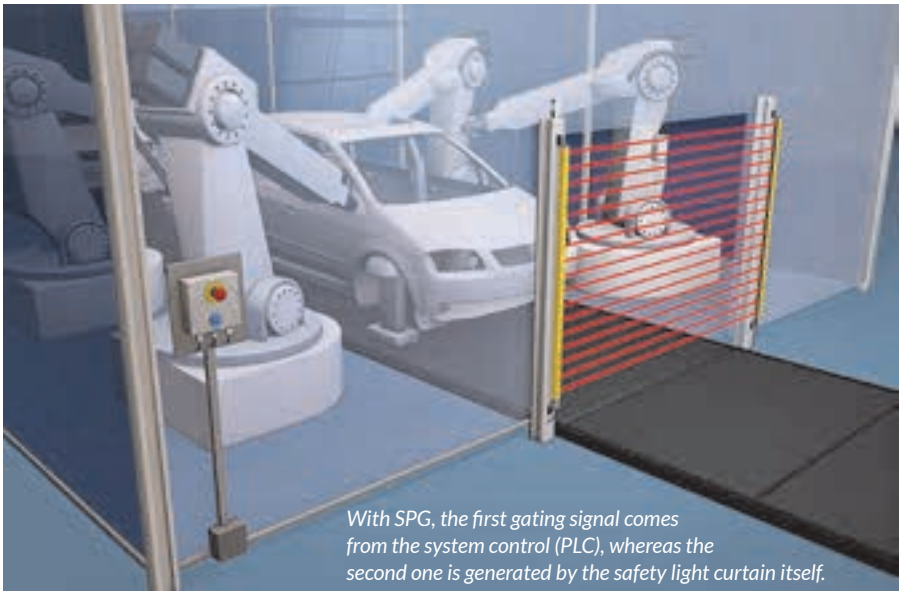
Explaining the purpose of muting sensors, Bryant adds: "Muting allows for safe access to protected areas without jeopardising the safety of the system. For example, if a pallet is moving through (in or out) of the protected area, muting will allow the pallet to move unhindered without breaching the safety barrier, which has been created to protect the workers."

Explaining the SPG process, Bryant says the first gating signal is sent by the process controller (PLC) to the safety light curtain shortly before the protective field is entered, to interrupt the protective device while the transported material is passing through. The second signal is, on the other hand, generated by the safety light curtain itself when the protective field is interrupted. SPG therefore requires knowledge of the position of the transported goods so that the necessary PLC control signals are within the correct time window at the safety light curtain.

"The point in time must be set such that the transported material is within 20 cm of the protective field, in order to prevent persons from slipping through," he says. "The safety light curtain generates the second signal in the protective field during entry and bridges the protective field."

Traditionally, according to Bryant, the protective field in a manufacturing or production cell was achieved by using safety light curtains with muting facilities. "SPG would be used in the palletising section of a bottling plant, for example. The protective field prevents access into areas which would be considered unsafe whilst production is in process," he explains.

The system control transmits a switching signal to the safety light curtain, whereby the described distance of 200 mm between the transported goods and the light curtain is maintained. Entry into the protective field must then take place in less than four seconds. During the entry, the safety light curtain generates the second signal and bridges the protective field while the transported material is passing through.



With SPG, the first gating signal comes from the system control (PLC), whereas the second one is generated by the safety light curtain itself.

In the basic configuration, the material must pass through in less than ten minutes, otherwise the receiver of the safety light curtain goes into an interlock state. If necessary, a timeout extension of up to 100 hours can be configured – to permit downtime, for example, during a shift change or over a weekend – without blocking the processes. When the transported material exits the protective field, the safety light curtain resets the signal.

The MLC 530 SPG safety curtain can be used in two operating modes for different conveyor speeds: a maximum speed of up to 0.6 m/s, and the other at less than 0.2 m/s. Depending on the selected operating mode, the protective field is then reactivated by the safety light curtain after one or two seconds. The transport material may not have moved more than 200 mm away from the protective field by this time.

Smart process gating (SPG) is a new process developed by global sensor solutions company Leuze.

The SPG system reduces installation and service costs because there is no set-up or alignment of muting sensors.

Summarising the advantages of Leuze smart process gating, Bryant considers the difficulties that the new system overcomes. "Smart gating eliminates the need for incorporating separate muting sensors as was the case with conventional safety light curtains," he concludes. ❑

Process control software: faster and

Advanced Process Control from Rockwell Automation has been taken to the next level by a software platform that combines empirical and first principles into a single composite model. Pavilion8 software uses an unrestrictive and robust configuration approach and is mooted to reduce the design and execution time of step tests by up to 30%, Christo Buys explains.

Pavilion8 is a modular software platform and the foundation for the Rockwell's Information Software & Process Business solutions. Leveraging a powerful modelling engine at its core, Pavilion8 includes modules to control, analyse, monitor, visualise, warehouse and integrate, all which are combined in this high-value application.

Pavilion8 Model Predictive Control (MPC) software now empowers engineers to design and execute step-tests faster, more safely and accurately. Unlike manual step tests that must be continuously monitored by on-site engineers, the Step Test Assistant in Pavilion8 (version 5.12) independently adjusts readings speedily in a test environment in order to identify models that drive operations to the maximum level of performance. This easy-to-use tool slashes testing time by up to 30%, avoids constraints for safer testing and helps reduce the need for repeat tests by adapting to and identifying good tests.

Manufacturers with complex processes leverage model-based, multivariable control to maximise uptime, reduce variability and control closer to the performance-limiting constraints. When a process has significantly changed, engineers conduct step testing to understand the effects each process variable has on other process variables. As each step test requires a series of small changes, it can be time-consuming to collect all the data, build algorithms and generate a dynamic model.

"Being responsible for the productivity of an entire operation relies on efficient operators and processes," said Christo Buys, business manager for control systems, Rockwell Automation sub-Saharan Africa. "Pavilion8 software is like having your best engineer available 24/7. It conducts complex, prescriptive analysis to identify the changes needed to improve performance."

The Step Test Assistant automatically schedules the next test until a sufficient number of good tests are achieved. This helps conduct step testing 20 to 30% faster than with manual testing processes. In addition, the tool learns and avoids constraints through MPC enforcement and provides predictive operation visualisation. Using manual processes, step tests usually require engineering oversight for 100% of the time. With the automated tool, however, step testing is repeatable, adaptive, protected and more accurately processed.

Pavilion8 v5.12 software is control system independent, but smoothly integrates with the PlantPAx process automation system from Rockwell Automation. It includes the following four key features:

- Windows-based configuration and support: The overall user experience for expert and inexperienced users alike begins with Windows-based solution builder tools, which improve workflow by enabling users to create a customised working environment and providing access to online help.
- Multivariable run-time controller: The robust run-time controller allows users to quickly add predictive disturbance rejection, new process limits, and easily compare differences in advanced process control (APC) application versions. Users can easily apply and adapt powerful, advanced MPC features with software supporting a flexible workflow. This reduces troubleshooting time.
- Continuous controller monitoring: Users can configure process models with specific metrics for production, quality, energy usage and other factors. They can also continuously measure their processes according to these metrics and use historical records to track and report ongoing benefits.
- Supports modern browsers and operating systems: To make the Pavilion8 experience consistent with other software environments, the software's user interface aligns with current technology standards. This includes support for newer browsers and operating systems.

more intuitive

The Pavilion8 platform is implemented in J2EE and based on a modern Service-Oriented Architecture (SOA).

All of the above factors allow the Pavilion8 software platform to adapt to changing business needs and to flexibly meet both simple linear and the most challenging nonlinear processes.

Modern approaches for batch applications

Industrial producers with batch applications can now create more flexible, reliable and productive operations with the latest release of FactoryTalk Batch software from Rockwell Automation. The modern software enhances scalability and responsive control of distributed, skid-level phases with the integrity of plant-level co-ordination, while delivering an improved, reliable user experience with built-in mobility.

Modern batch software now improves batch responsiveness, scalability and productivity, and supports mobile devices.

"Rather than trying to force-fit applications into rigid batch control systems, producers can now customise a modern batch system to their application's needs," said Buys. "These enhancements give batch producers greater flexibility when designing, operating and expanding batch systems. They also enable producers to use mobile devices for a more intuitive experience and improved workflows."

Integration with the SequenceManager solution enables batch sequencing to occur at either the controller or server level. This allows machine builders to develop and deliver fully tested skids that end users can integrate into their batch process with minimal validation and commissioning effort. It also minimises the rework required when manufacturers with small, controller-based batch systems expand to larger, server-based systems.

New mobile support can help create intuitive workflows, reduce procedural steps and increase collaboration. With mobile devices, workers no longer need to be bound to control rooms and fixed terminals. Instead, they can access real-time information, interact with processes and secure approvals from anywhere in a plant. A modern web interface also helps reduce the number of clicks required to access information. ❑

Sanitary tilt-down flexible screw conveyor

New from Flexicon is a sanitary flexible screw conveyor that can be tilted down and rolled to serve multiple functions. Using a manual jackscrew, the support boom and conveyor can be raised for discharging into vessels or other process equipment. Fully lowered, it can be rolled through doorways as low as 2 134 mm in height and aisles as narrow as 1 067 mm.

Sanitary features include: a castor-mounted frame, support boom and hopper grate constructed of 316 stainless steel, sanitary quick-release clean out cap, quick-disconnect discharge box access cover, stainless control panel with stainless conduit, and liquid-tight compression fittings, allowing wash down during changeovers and/or conveying of corrosive materials.

HMI controls allow manual and automatic start/stop and speed adjustment. Material flows through the hopper into an adapter that charges the conveyor. As the flexible screw rotates in the material, it self-centres within the tube, providing ample clearance between the screw and the tube wall to eliminate or minimise grinding. The flexible screw is top-driven beyond the point at which material exits the conveyor, preventing contact with bearings or seals.

The conveyor transports bulk materials from sub-micron powders to large pellets, while the gentle rolling action of material prevents the separation of blends.

The rugged inner screw is the only moving part contacting material, resulting in reduced maintenance and increased reliability. A broad range of screws with specialised geometries is available to handle free- and non-free-flowing materials, including products that pack, cake or smear in other types of conveyors.

The conveyor frame can be finished to sanitary or industrial standards, and constructed of carbon steel with durable industrial coatings.

Flexicon manufactures numerous types of stationary flexible screw conveyors as well as tubular cable conveyors, pneumatic conveying systems, bulk bag dischargers, bulk bag conditioners, bulk bag fillers, bag dump stations, drum/box/container tippers, drum fillers, weigh batching and blending systems, and engineered plant-wide bulk handling systems with automated controls. ❑

Spike Taylor, managing director of Multotec Rubber.

Multotec's wear and risk warning systems

Early warning systems across a range of Multotec's wear solutions – built in as standard and at no added expense – are important aspects of the group's efforts to save customers from the high cost of unexpected failure.

According to Spike Taylor, managing director of Multotec Rubber, the company's wear systems are simple but highly effective, assisting customers in achieving the longest possible life between replacements and reducing plant downtime.

"Apart from providing customers with cost-effective solutions, we also want our customers to have the best user experience when working with our products," says Taylor. "To do that, we have designed early warning systems that can be visually checked with ease and with high levels of safety."

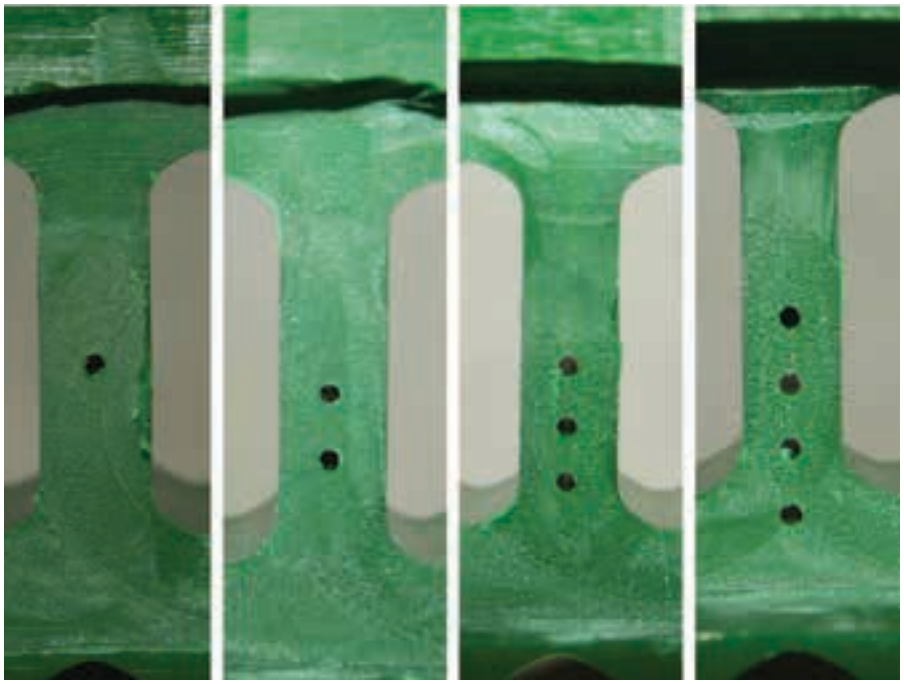
He highlights that the successful implementation of these systems was done without raising the products' cost to customer, a significant advantage for customers, as most of them use large quantities of Multotec wear products in their equipment.

The Group's wear solutions are applied to a range of applications including mills, scrubbers, pipelines, transfer points and chutes

Screen panels

Screen panels, produced by Multotec Manufacturing in a range of materials, need to be replaced at the right time if the customer is to derive the most value from them. "This time can either be just before the metallurgical end-of-life or before the apertures on the panel are worn too large," Taylor says. "With, typically, hundreds of panels on a screen deck and uneven wear across the screen, it is crucial to identify the most worn panels and to replace them. If this is not done, the panel could wear through, allowing oversized particles to pass into the underflow and block or damage downstream equipment, not to mention the unplanned downtime that this would incur."

The wear indicator on each panel comprises four or five moulded cavities in the body of the panel, spaced at predetermined intervals below the upper wear surface. "The cavities are like pin-holes, large enough to be visible to the naked eye but small enough to prevent material getting into them and blocking them from view," says Taylor. "As the panel surface is worn away, one cavity becomes visible and, as further wear takes place, the second cavity is also visible, and so on until all cavities are visible and the operator knows that replacement must be conducted or planned shortly."



The wear indicator on Multotec's screen panels comprises four or five moulded "pin-hole" cavities in the body of the panel, spaced at predetermined intervals below the upper wear surface. The holes become visible one by one as the pane wears.

This simple but innovative system, patented by Multotec, not only indicates when replacement needs to take place, but can be used as a data source to measure the rate of wear so that a future replacement time can be predicted and planned.

"Accurate recording of the time lapse or the tonnage treated between the exposure of one cavity and the next allows the customer to calculate a wear rate," Taylor explains. "This rate lets the customer work out the panels' life with considerable certainty, so that a future change-out date can be accurately set."

The number of cavities that are exposed before replacement is carried out will depend on the different perforated thicknesses or aperture sizes and the harshness of the application in question.

Cyclones

Group company Multotec Process Equipment supplies a wide variety of cyclones, among them the HC cyclone range, which comprises a mild steel outer shell and an inner, wear surface of thick, loose rubber lining. "The key design feature for early warning of wear is a 'weep hole' in the mild steel shell," Taylor explains. "If the rubber lining wears through or is severely damaged by a large or sharp particle, the slurry will leak between the lining and the shell and escape from the cyclone through the weep hole – which is filled only with a loose plastic insert. The internal surface of the plastic inserts prevents the liner from blocking the weep hole."

Being alerted to the lining failure by slurry on the plant floor removes the risk of the steel case being irretrievably damaged while not protected by the lining, which would lead to the expensive and time-consuming process of changing the cyclone body.

The advantage of the weep hole is also that the inspection of the cyclone can be done while it is in operation. As soon as a problem is identified, the cyclone can simply be removed from the circuit and, if possible, substituted while the loose liner is replaced. This also means that the maximum lifespan of the liner can be extracted, helping reduce operating costs.

The weep hole allows inspection of the cyclone to be done while it is in operation.

The natural rubber linings, which come in thicknesses of 15 mm and 25 mm, have three times the life of conventional liners and a new compression-moulded rubber is also available, having been developed by Multotec after extensive research and testing.

Rubber wear plates

To combat wear in ore transfer chutes and similar applications, Multotec Rubber supplies rubber wear plates that now also come in 'Yellow Belly' format.

"Our recent innovation with these products has been to colour the layer of rubber immediately above the steel backing plate a bright yellow, hence the name," says Taylor. "When the wear on the rubber plate reaches the level of the yellow rubber, the colour is easily visible during inspections; this indicates that there is still some life left in the plate but that replacement must be conducted in the near future to avoid damage to the backing plate."

He emphasises that the yellow rubber is the same good quality as the black rubber that Multotec has installed in high-impact and high-abrasion applications throughout Africa. So the remaining wear, after the yellow colour is first exposed, gives the plant operators time to decide whether they want to replace the plate immediately or address it during an imminent, scheduled process plant shutdown.

Multotec's rubber wear plates range in size up to 1 260×1 320 mm and 1 000×2 000 mm, which can be cut to suit the liner configuration. They are available in a thickness from

Manufactured in Multotec's Spartan facility, the yellow rubber in the company's Yellow Belly Liner is the same high quality as the Multotec black rubber installed in high-impact and high-abrasion applications.

40 mm to 200 mm including the steel backing plate, which measures from 3.0 mm to 10 mm thick, depending on the rubber thickness and the application.

Ceramic tiles

Multotec engineers its ceramic wear solutions to order, according to individual customer requirements, a full on-site wear audit is the best way to determine which lining solution will best suit the customers' application specifications.

A big user of ceramic tiles is the power generation industry where they are put to work to protect pulverised fuel pipes, fans, coal handling chutes and hoppers. The tiles also provide a hardwearing solution in the mining industry on equipment such as vibrating feeders, transfer chutes, cyclones, pipes and other traditional high-wear areas.

A wear warning in Multotec Wear Lining's ceramic products has been introduced in the form of the Green Dot tiles; the early warning system here is also based on colour; the operator is alerted to wear by a change in colour on the tile surface.

"The tiles have a central, multi-coloured cylindrical plug bonded to the tile which acts as a wear indicator," he says. "The top, thicker section is green while the lower section is red. When the red 'dot' appears during a maintenance inspection, the operator knows that significant wear of the tile thickness has taken place and the replacement of the worn section should be planned."

Taylor emphasises that the Green Dot tiles do not need to be installed over the complete lined surface; rather, installation in a predetermined pattern can help detect when tiles in a high-wear area need to be replaced.

In addition to making inspection easier and quicker, inspection also becomes safer, as the person checking does not usually have to physically enter the chute to make the inspection. Instead, he or she can do a visual inspection from the access hatch.

Data to predict wear

The value to the customer of Multotec's range of wear solutions and early warning systems is enhanced by the Group's Hawkeye™ web-based system for capturing and recording wear and life data for mill liners, screen panels and cyclone components. Using the early warning innovations to measure component wear during operation, then capturing this data in the powerful Hawkeye™ software, allows customers to accurately predict the next change-out date and to reduce the chances of unplanned stoppages.

By keeping historical database records of component life versus tonnage treated, the program can analyse data to determine the necessary design changes that will extend life. As the system is web-based, mine personnel have access to the information at any time to help them with vital duties such as order placement and budgeting. ❑

Can we give simple answers to complex realities?

In this month's Materials engineering in practice column from the Wits School of Chemical and Metallurgical Engineering, *Tony Paterson* argues against attempts to simplify future engineering decisions based on predictions from the past.

There are some dangerous types at large in the engineering sector. Most people never recognise them for the effects of their inputs. They are the gurus who are peddling simple answers. Of course, most people love simple explanations and their corollary, simple predictions.

To put this into context, I refer to numbers of telephone calls that ask a simple question about material selection or application, the essence of which is 'will it work?' without any appropriate context. Asked about context, the questioner, often a buyer, has no idea. But operating circumstances, demands, materials and processes vary, so how can the question be regarded as simple. Often people feel the most obvious solution is the correct one and that, as an expert, the answer should be straightforward. Sometimes it is, but not often.

The simple answer preference is so pervasive at times that one worries when anyone starts off by saying he or she is going to apply the KISS principle. While they think KISS means, 'keep it simple stupid', it really means: 'I keep it simple, because I am stupid'. The implication is that if one cannot give a simple answer then one is not behaving intelligently. However, I have found that the more I learn, the less I feel I know.

The skills expected of the engineer are those of judgement and compromise as shown in the attached Figure 1. Uncertainty is ever present.

One of the things that the KISS brigade does is to look at the past and develop simple explanations. These explanations may be based on coincidences or different operating circumstances. The facts may be twisted or carefully selected to fit tidily into their perfect picture of the past.

This is not to suggest that the past or past experience have no role. Where the smoke and mirrors trick comes in is that, having convinced people they have a plausible, simple explanation of the past, they then present an equally simple prediction of what will happen in the future. This is a huge leap. Just because one can explain what happened in the past does not mean that one can predict the future. Analysing what is known is one thing; one can simplify in retrospect based on perfect science; but fortune telling is another matter. This distinguishes between puzzles and mysteries.

Comparing puzzles to mysteries, puzzles are resolved with additional information. Puzzles optimise, mysteries require satisficing (doing the best possible). Puzzles are transmitter dependent; they turn on provided information, or what one can deduce from that information.

Mysteries require judgment or mutual adjustment and the assessment of uncertainty. The hard part is not that one has too little data – often one has too much. One has to sort between the relevant, sufficiently accurate and available data to achieve information. Mysteries are receiver dependent; they turn on the skills of the interpreter. This does not imply that puzzles are necessarily easier than mysteries. In Figure 1, for example, calculation may be simple or complex, the point is a single answer. It only says that the need for judgment or adjustment falls away. In this sense puzzles are static. Systematic guessing is often required for puzzles but there is only one solution. This is not to say that one cannot learn from the past, but one needs to understand what one has learned in context.

Principle KISS proponents frequently rely on the past. Their proposition is that they have gone back through experience and identified a common thread. Then they pull the rabbit out of the hat. Questioners hate uncertainty. They like confident, simple answers

One can consider the dilemma of salmon as illustrated in Figure 2. Salmon spawn at the protective start of rivers but live in the sea. Hatchlings born upstream swim downstream to the sea following the current.

At the end of the season the fish return to their places of birth to start the cycle again. Whereas as hatchlings they simply followed the current, when swimming upstream there are choices to be made at each intersection. This far more complex.

	Objective which maximises achievable benefit		
Effect of a possible decision choice		KNOWN	UNKNOWN
	KNOWN	Calculation (puzzle)	Mutual adjustment – Compromise (Mystery)
	UNKNOWN	Judgement (mystery)	Intuition

Figure 1: The impact of uncertainly on decision-making.

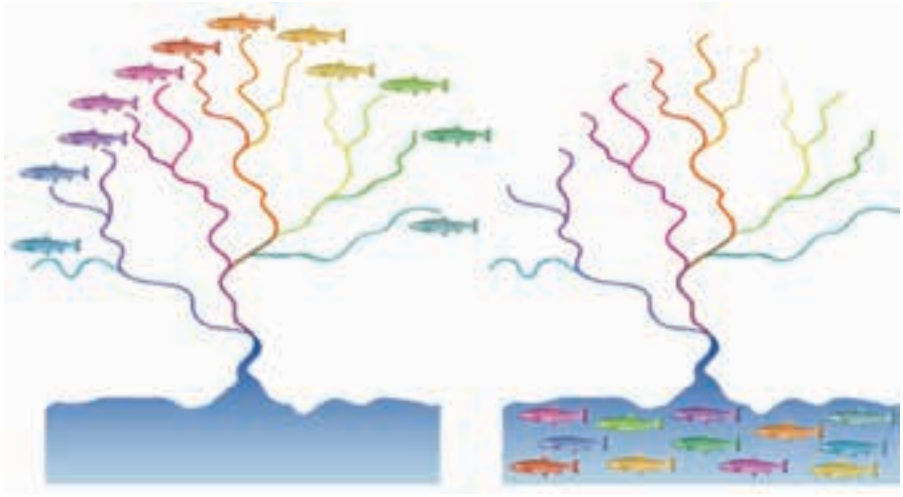


Figure 2: The life cycle of salmon: swimming upstream as an adult is far more complex than swimming down to the sea as a hatchling.

Uncertainty in engineering

If one is inclined to believe that engineering lies solely in the calculation box, even for a moment, it is time to take a cold shower. The

Sanitary piping is stainless steel high purity tubing for biopharmaceutical, food and beverage facilities. Whilst the focus had always been structural integrity, the issue of hygienic joints introduced new fabrication challenges to allow the systems to be cleanable and eliminate bacterial entrapment areas.

world is a far from simple place. Operational circumstances, economic, political and cultural systems that affect outcomes are highly complex. They have a myriad of interacting variables. The relationships between those variables are shifting constantly. For any decision there are normally between four and seven significant variables. These need to be identified, then controlled, influenced or simply monitored (in the case of exchange rates, for example).

The perceived uncertainly associated with decision environment characteristics is shown in Figure 3. The significant operating circumstances govern the decision environment and these may or may not be static and time dependent. A balance within the context of the significant variables enables reasonable assessment and understanding of associated risk.

Conclusions

The first thing to take from this article is that nobody knows exactly how a material or design will react over time. Sure, there will be lots of people making guesses. It is even certain that some of those guesses will turn out to be right. A new guru will be born, who will have his or her time in the sun until their next major prediction fails miserably. It has always been so.

The second thing to take away from this article is that there is often no need to make absolute predictions at all. Engineers all need the skill to identify the full set of predicted operating conditions that affect choices, combined with the ability to work out a strategy for when the situation changes.

The engineering concern is not to predict with certainly but to recognise fairly soon if significant changes have occurred. A strategy for deviations is required. An example of this is the food and beverage sector, which made investment decisions in the 1980s based on functional compliance. In the early 2000s new legislation related to health has emerged alongside the sustainability criteria. This limits acceptable bacteria and spore counts in the final product. Bacteria are directly associated with the build-up of bio films on product contact surfaces.

The characteristics of environmental factors		The degree to which factors are few in number and similar to one another.	
		Simple	**Complex**
The degree to which factors remain stable or are in a continual process of change.	**Static**	Low	Moderately low
	Dynamic	Moderately high	High
		The extent of perceived uncertainty affecting decisions.	

Figure 3: Perceived uncertainty compared to decision environment characteristics.

Whilst the focus had always been structural integrity, the hygienic welding of joints introduced new challenges. These hygiene requirements, which prove more demanding to achieve than structural integrity, are in addition to other operational requirements.

The approach to engineering choices should work well. It has in the past. It requires understanding by client bodies. It is neither fun nor simple. If you want simple answers to complex circumstances, take some of your money down to the casino. Infrastructure engineering is not the place to gamble on simple answers, even when the questions posed are simple to express. ❑

Investment in Africa offers shortcuts

According to Louis Meiring, CEO of the Johannesburg-based Zest WEG Group, by far the most important aspects of foreign investment are the access to global operations, the transfer of technology, and the ongoing training and skills upliftment.

"WEG initiated a programme to uplift the Zest WEG Group facilities to become world class," says Meiring. "This puts our local manufacturing facilities onto an international platform so our products can be considered for international markets, including the existing WEG network of operations worldwide."

He says Zest WEG Group will also use the WEG world network as a source for enquiries, to create business opportunities and bring much-needed international business to South Africa.

"This is all perfectly feasible through technology transfer, as we have the resources to skill and train our people," he says. "Once again, however, there is more to technology transfer than just training."

Technology transfer also shows the benefit of lessons learnt in the process of research and development (R&D). "These lessons, which have been learnt by the WEG Group through decades of experience, will have an immeasurable impact on our local operations, due to the high levels of R&D already conducted," says Meiring. "This technology is then transferred to the local operation without us having to incur the cost or the time to develop it."

Zest WEG Group has long been an active player in skills upliftment, with a reputation for the quality of its training centre and training programmes: all of which are accredited by the relevant authorities for the provision of continuous professional development (CPD) points.

"We conduct training not only for our own staff but for our customers too," Meiring says. "We see this as vital in addressing the skills void in various segments of the electric motor sector, created during the late nineties and early 2000s when becoming an artisan was not considered to be a career of choice."

He says that, as a committed partner and a leading manufacturer of electric motors worldwide, WEG has continued the training ethos long established by Zest WEG Group. Its training interventions extend beyond South Africa to other African countries, with the training officer regularly travelling across the continent to ensure that the relevant technology is shared wherever necessary.

The focus on skills is not only on the technical side of industry, but should also extend to management capacity to ensure that high levels of technical ability are properly implemented in the work process.

www.zestweg.com

WEG Transformers Africa's manufacturing facility.

Test bunkers commissioned for valves

Mokveld Valves BV in the Netherlands, for whom Energas Technologies is the South African distributor, provides expert knowledge and highly advanced engineered valve systems for critical control and safety applications to the gas and oil industries and has recently commissioned two new test bunkers for testing critical, high quality valve systems.

Over the years, Mokveld has seen increasing customer demand in terms of both quality and safety. In response and to better fulfil customer needs, Mokveld has designed and engineered two new unique test bunkers that were both developed internally.

The test bunkers have been engineered to the company's exacting standards and in line with the industry's demands for specific tests, such as fugitive emissions, PR2 or type approval testing combined with Mokveld's large dimension, high pressure valves that offer extreme specifications that are not available in standard testing equipment.

By commissioning the test bunkers, Mokveld has placed itself at the forefront of what is possible in terms of both pressure and temperature testing of valve systems. "A great advantage of having these facilities in-house is that we no longer need to involve third parties in our workflow," says Chris van Assem, marketing and communication manager for Mokveld.

The bunkers allow pressure testing with nitrogen and helium at up to 1 200 bar and temperature testing is possible within a range of -196 °C to 200 °C.

www.energas.co.za

Mokveld Valves in the Netherlands has recently commissioned two new test bunkers.

Rand-Air docks at Saldanha Bay

Leading compressor and generator hire company, Rand-Air, is determined to provide uncompromised service to its customers, as well as reliable and well-maintained equipment. As part of this commitment, the company recently opened a branch in Saldanha Bay, in an effort to expand its reach across the country.

"The need to support the steel industry and related contractors within this sector was imminent. Rand-Air recognised this as an opportunity to service this market in a better way," explains Louwrens Erasmus, general manager at Rand-Air.

The Saldanha Bay project aims to create a world-class, internationally recognised and respected South African marine engineering hub. "Stimulating the local economy is of immense strategic importance to Rand-Air. We understand that expansion is the most effective, most economical and most sustainable way of creating jobs, which is paramount to a healthy economy," Erasmus continues.

As the economy continues to develop, it has become more important than ever for large operations to focus extensively on their primary core-business. Outsourcing is a popular method to enable this as it facilitates operational efficiencies. Not only does outsourcing alleviate the pressure of maintaining equipment, but it is also the most cost-effective option as no capital outlay is required.

www.randair.co.za

Virtual reality at PEWA 2017

Cummins, a global power leader that designs, manufactures, distributes and services diesel and natural gas engines and related technologies, demonstrated its recently launched Virtual Reality training and marketing device at Africa's Power & Electricity World Africa (PEWA) Exhibition.

The Cummins exhibit showcased two sets of high-tech equipment for media and customers to experience. By wearing goggles and a headset, one is swept into a simulated 3D tour of a plant or data centre, complete with sound: a trip into the world of virtual reality. The viewer is introduced to various products in a data centre, including the recently launched QSK95 Series high-horsepower generator sets. The QSK95 is specifically designed and engineered for critical applications that demand a robust, reliable source of power to ensure uninterrupted operations, for applications such as hospitals, sports stadiums, office buildings, data centres and such like.

Commenting at the exhibition, Kenny Gaynor, director of power generation for Cummins Southern Africa said: "This incredible, innovative device has been engineered for use in training and education, providing a new and dynamic teaching experience. Innovation is about unlocking and unleashing new ways of thinking, doing and delivering against a background of continuous improvement." The compact and portable headgear provides endless marketing opportunities for the broad range of products.

Cummins graduate, Siandri Naiker demonstrates virtual reality equipment to PEWA delegates visiting their stand.

Remote monitoring is another example of Cummins' focus on innovation. This cloud-based, state-of-the-art technology is a key differentiator for the company, providing support for equipment via the cloud, relieving the pressure on local specialists. The technology provides real time data from a Cummins controller via a cell phone or email, alerting the customer by providing information that predicts future problems and power outages. Downtime or maintenance issues can then be prevented and scheduled accordingly.

Typical applications for remote monitoring include maintenance, multi-building businesses that are controlled by one data centre, telecommunications, banking, hospitals and franchisee businesses.

www.cummins.com

Connected Industries conference

South Africa's key automation and industrial control event, Africa Automation Fair, will be hosting a high-level conference on Connected Industries in line with growing international focus on the 'The Industry 4.0, and the advanced, connected industries of the future. The event, to be staged at Johannesburg's Ticketpro Dome from 6 to 8 June, aims to update local automation and process stakeholders on key trends in global manufacturing and process management.

"There is significant interest across Africa in Industry 4.0, in which smart production methods make processes more efficient and cost-effective," says conference director, Hanli Goncalves. "We are bringing leading European experts to South Africa to update our public and private sector players, large manufacturing and processing plants, and the petrochemical, automotive and mining sectors on the latest trends and best practice internationally."

The Connected Industries conference specifically for the automation and control industries is a first in South Africa, and conference organisers, Reed Exhibitions, envisage taking the event on the road to East and West Africa in future. Africa Automation Fair and the Connected Industries conference have been endorsed by, and have secured the participation of, a significant number of local and international industry bodies, as well as the South African Departments of Trade and Industry and Science and Technology.

www.africaautomationfair.com

Largest food and bev centrifugal pump in SA

As part of its new Packo range of food-grade pumps, a new centrifugal pump called the Colossus is now available from Verder South Africa. This pump, an extension of Packo's MCP3 and MFP3 pump range, weighs 1.6 t and offers a flow rate of 1 200 m^3/h, with a 200 kW motor. It is also capable of pumping beer into eight million 250 mℓ bottles an hour. The product was launched towards the end of last year.

The Dutch-based Verder Group acquired the UK-based Fullwood Packo Group in 2015, with Verder South Africa embarking on an extensive marketing campaign for the food and beverage industry.

Kobus Fourie, Packo pump specialist at Verder South Africa, explains that the range has application in 11 niche sectors. These are dairy, meat and fish, textiles, wastewater and potable water, breweries and distilleries, food and beverage, washing and disinfection, surface treatment, vegetables, animal feeds, biogas, hot frying oil, petrochemicals and pharmaceuticals.

"At the moment, our campaign is focused on the breweries and food and beverage industries," Fourie confirms. Globally, a demand for increased production capacities and more efficient processes in the food and beverage industry has seen a need for stainless steel pumps with flow rates in excess of 1 000 m^3/h.

Hence the launch of Verder's Colossus into South Africa, with a stainless-steel design that is more hygienic than cast iron equivalents. "Colossus is likely to become the standard in the food and beverage industry in the future," Fourie comments.

The MCP3 and MFP3 pumps are also energy-efficient and easily maintained, with an electro-polished finish that is corrosion-resistant and easy to clean. The pumps are a particularly reliable option for filtration applications, pasteurisation, yeast propagation and in cleaning systems.

Fourie reveals that Packo itself is undergoing an expansion and renovation of its facilities, which will allow it to manufacture and test pumps with a flow rate of up to 2 000 m^3/h.

www.verderliquids.com/za/

New instruments for faster results

Leading condition monitoring specialists, WearCheck, recently invested in excess of R1.7-million in new high-tech equipment in both the transformer and fuel sections of their Johannesburg-based speciality oil and fuel sample laboratory.

The Kruss K11 tensiometer, an ADU 5 distillation unit, a SVM3001 Stabinger viscometer as well as the PMA 5 Pensky-Martens closed-cup flash point tester are among the new pieces. These highly accurate, sophisticated instruments have not only boosted the lab's productivity by offering new tests and saving time on existing ones, but have also reduced the turnaround time to generate customers' sample results.

The ADU 5, a fully-automated distillation unit that is operated by a touch screen interface, performs distillation tests according to ASTM D86. This is recognised as one of the most reliable methods of determining the boiling range characteristics of petroleum products, and is a critical measurement of the overall performance and safety of fuels.

WearCheck's new ADU5 distillation unit is operated by senior lab technician Lizzy Chabangu.

The SVM3001 is a Stabinger viscometer, which is capable of multiple parameter measurements in a single analysis, eliminating the need for many separate tests.

The instrument can simultaneously measure kinematic viscosity according to ASTM D7042, dynamic viscosity, as well as the density according to ASTM D4052 in lubricating oils, base oils, additives and fuel oils. The automatic PMA 5 Pensky-Martens closed-cup tester measures the flash point at the lowest temperature at which the application of an ignition source causes the vapours of a sample to ignite. This instrument is suitable for flammability applications on fuels such as diesel, heating oil, kerosene as well as both biodiesel and biodiesel blended fuels.

The ADU 5, SVM3001 and PMA 5 are upgrades to existing equipment operated by WearCheck, which have led to improved service delivery and reductions in turnaround times.

Using the Kruss K11 tensiometer, the analysis of the decomposition product content of transformer oil is done in accordance with ASTM D971. This fully-automated instrument conducts precise measurement of surface tension and interfacial tension (IFT). This data is key in the maintenance of transformers and in making informed decisions on whether to extend the life of the oil – a useful way to save customers money.

www.wearcheck.co.za

Rugged precision laser level

Fluke, represented locally by Comtest, has just launched its new rugged Fluke laser levels. Designed and tested to survive a one-metre drop, users have come to rely on Fluke's professional-grade tools that provide precision and accuracy. The 3-point laser level delivers accuracy to 6.0 mm at 30 m and the continuous line lasers levels are accurate to 3.0 mm at 10 m. The fast settling, self-levelling gimbal gives users accurate reference points and lines almost instantly, making long and tedious layouts a thing of past.

Fluke-3PR and Fluke-3PG instruments are self-levelling 3-point laser levels that allow for fast, accurate layout of reference points over longer distanced (60 m). These include floor-stands for fast, easy overhang and centreline measurements

The Fluke-180LG from Comtest.

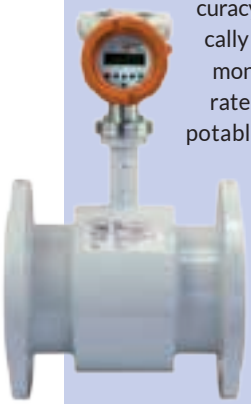
and the green laser line is up to three times brighter for improved visibility for long-range applications (Fluke-3PG only).

The Fluke-180LR and Fluke-180LG are self-levelling, horizontal- and vertical-cross line lasers that are accurate to 3.0 mm at 10 m and also feature brighter green lasers.

www.comtest.co.za

Electromagnetic inductive flowmeter

KOBOLD, represented locally by Instrotech, has on offer a newly developed electromagnetic inductive flowmeter for conductive fluids – the model DMH – with a standard accuracy of ±0.3%. It is used specifically for the measurement and monitoring of the volume flow rate of acid or alkaline fluids, potable (drinking) water, waste water, pulps, pastes and other electrically conductive materials, without loss of pressure.



When an electrically conductive medium passes through a directional magnetic field, a voltage is induced in accordance with Faraday's Law of Induction. The size of this measured voltage is proportional to the mean rate of flow and consequently also to the volume flow rate.

A flowmeter consists of a sensor that picks up the measuring signal generated from the induced voltage, and a transducer that converts this signal into a standardised output signal (4-20 mA or pulses). The measurement transducer can be affixed to the sensor or mounted separately. Pressure, temperature, density and viscosity do not affect the volume measurement although solid fractions and gas bubbles should be avoided.

The microprocessor-controlled UMF2 converter guarantees the highest of accuracies and with its alpha-numeric backlit LCD terminal, six keys, plain text response and plausibility check for entries, the system is easy to operate.

Empty-pipe detection, coil current monitoring, and plain text error messages guarantee full control over the sensor and measuring points at any time. Pulse, status, and current outputs as well as HART® communication are standard features, all of them electrically isolated. Lining materials such as hard rubber, soft rubber, PTFE or PFA are also available.

A wide range of standard and special electrode materials is on offer, including Hastelloy, platinum, and tantalum. The DMH is available for nominal width of DN10 to DN1200 and for flow velocities up to 10 m/s.

www.instrotech.co.za

XCell sensor technology brings improved gas detection

Volatile Organic Compounds (VOC) can pose serious health hazards if inhaled by those working in harsh environments. MSA Africa's Altair 5X has been improved to include XCell Sensor technology, which plays an important role in ascertaining safety and, significantly, reducing exposure risks.

MSA Africa respiratory and fire helmets product manager Suraksha Mohun says that the Altair 5X has a fast sensor response, 15 seconds faster than a standard sensor. "XCell Sensor technology, which enables faster response and span calibration times. This multigas detector is capable of detecting emissions of six different gases at a time; CO, H_2S, O_2, SO_2, Cl_2, NH_3 and more."

It boasts MotionAlert and InstantAlert, which are additional safety alarms. Mohun adds that the Altair 5X is agency approved and holds an IP 65 rating certification. "The sensor will last for at least four years and can survive multiple incidental drops of up to 3.0 m onto concrete. Our customers will also continue to benefit from the fast sensor response of MSA XCell combustible, toxic and oxygen sensors currently used in the Altair 5X."

A Photo Ionisation Detector (PID) can be added to the compact instrument, which can be worn all day unlike most PIDs. It includes Bluetooth wireless technology that can be used with Android devices and the MSA app to wirelessly manage instrument data and setup. "It has proved to deliver advanced safety and cost savings for thousands of satisfied customers worldwide," Mohun continues.

VOC detection can now be fully integrated into customer instrument fleets using the GALAXY GX2 Test Stand and MSA Link Pro Fleet Management software infrastructure, enabling data access and control of the Altair Gas Detector. It has an 18 language capability and comes complete with sensors and a rechargeable battery with 13 hour capacity. What's more there is a two-year warranty on NH_3 and Cl_2 XCell sensors.

www.msasafety.com

Enabling utilities and the solar industry

At Power and Electricity Worlds Africa (PEWA), Eaton, showcased a selection of generation, transmission and distribution solutions for power utilities and solar solutions.

"Energy is the largest source of growth in Africa and we see the biggest potential in renewable energy as costs are decreasing," explained Seydou Kane of Eaton Africa.

Products on display included: Power Xpert CX®, Eaton's IEC-compliant low voltage power distribution system for up to 5 500 A. The system provides reliable power distribution and motor control functionality for all commercial and industrial applications.

In addition, Eaton featured the Power Xpert UX, an innovation in its Unitole family of field-proven vacuum circuit breakers. This air insulated, withdrawable, medium voltage switchgear now leads the industry in safety, reliability, performance and sustainability.

Further products on display were the Xiria E Modular Switchgear for safe smart grid applications of up to 24 kV.

www.eaton.co.za

High-power artificial muscle for

As part of the Impulsing Paradigm Change through disruptive Technologies Programme (known as ImPACT), and its 'Tough Robotics Challenge' – an initiative of the Japanese Cabinet Office Council for Science, Technology and Innovation – a research team including Professor Koichi Suzumori from the Tokyo Institute of Technology and Dr Ryo Sakurai from Bridgestone Corporation has succeeded in developing a hydraulically driven, high-power, artificial muscle that is expected to become part of the smallest, lightest and most powerful consumer robots yet created.

The purpose of the ImPACT Tough Robotics Challenge is to create the various 'tough technologies' that are essential for robots used for disaster prevention, emergency response and recovery, rescue and humanitarian support.

Robots that operate in disaster areas need to be lightweight, powerful, capable of controlling large forces precisely, have sufficient shock resistance and other mechanical 'toughness'. These are different from robots used under specific controlled conditions indoors and in factories. Methods using electric motors and reduction gears have limitations so hydraulic actuators are essential.

This research has developed a new McKibben type artificial muscle that can be driven by hydraulic pressure of 5.0 MPa, which can generate significantly more power than conventional methods while remaining lightweight.

In addition, the solution minimises sliding friction, which becomes an issue when trying to achieve high precision control, and it has strong resistance to shock. It is expected that this component will allow for great progress to be made towards the practical application of robots in extreme environments.

The ImPACT programme's artificial muscle, developed using rubber tube, is extremely powerful but lightweight and is strongly resistant to impact and vibration, allowing for the most compact, tough and energy-efficient robots ever created, which are all keys for robot use at extreme disaster sites.

ImPACT's Tough Robotics Challenge targets the development of robots for rescuing people after disasters such as the Great East Japan Earthquake Disaster and the Han-Shin Awaji Earthquake Disaster. With existing robots, a number of problems tend to arise. For example, it has been reported that they cannot operate at disaster sites, that there have been total breakdowns and that they do not meet the working conditions. These problems must be overcome in order to achieve the programme goals.

To create tough robots with excellent mobility and power, the researchers are carrying out research and development of hydraulic actuators such as motors and cylinders, which are key components. Most current robots are driven by electric motors based on technology commonly used for consumer products; however, there are problems related to their structure.

First, the strength-to-weight ratio, calculated by dividing the generated force by the weight of the actuator, is low – electric actuators are low powered and heavy. Second, the robots have low resistance to outside impact and vibration – they break easily – and third, it is difficult to achieve large power output while also moving gently, which these situations often require.

To address these problems, the Tokyo Institute of Technology and Bridgestone have focused on the development of human-like muscles, which are capable of expending large amounts of power whilst also being capable of the flexible movement required to do the work required. Since 2014, the researchers have been striving for output greater than that possible by human muscles, while simultaneously trying to reproduce their flexibility.

These artificial muscles consist of rubber tubes and high-tensile fibres, and are actuated by hydraulic pressure. The use of rubber tubes and high-tensile fibres make it possible to achieve smooth movement, and the use of hydraulic pressure makes it possible to achieve a high strength-to-weight ratio, high shock and vibration resistance, and appropriately gentle movement.

This research opens up new possibilities for creating robots that have greater 'toughness' than current robots; are highly resistant to external shock and vibration; able to perform high intensity jobs; and handle delicate jobs requiring precise power control.

Overview of research achievements

The high-power artificial muscle that was successfully developed is a McKibben type artificial muscle. As seen in Figure 1, it consists of a rubber tube surrounded by a woven sleeve. Conventional McKibben type artificial muscles operate at an air pressure of 0.3 to 0.6 MPa, but the artificial muscle developed

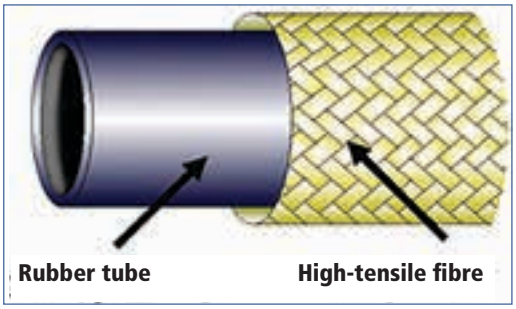


Figure 1: The McKibben-type artificial muscle structure.

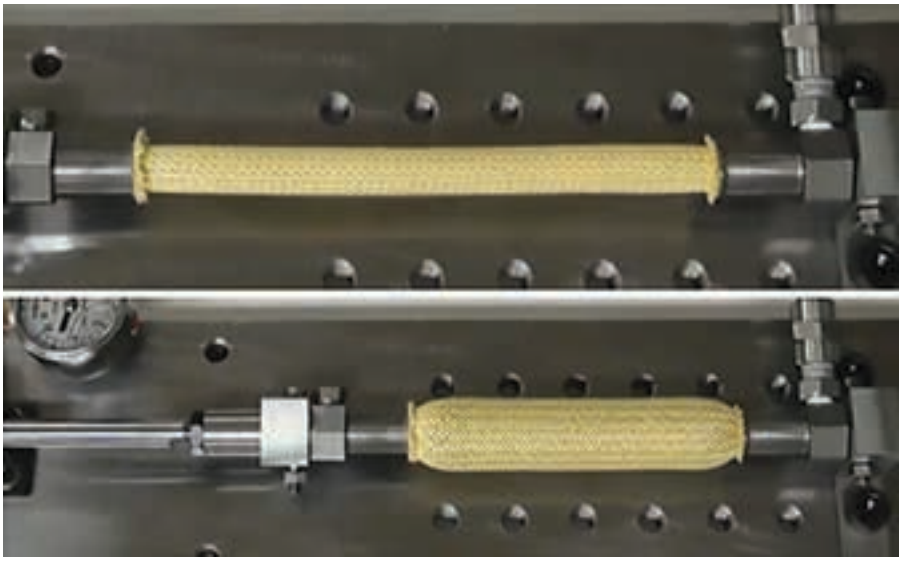


Figure 2: An example of the operation of the hydraulic, high-power artificial muscle' developed through the ImPACT programme.

consumer robots

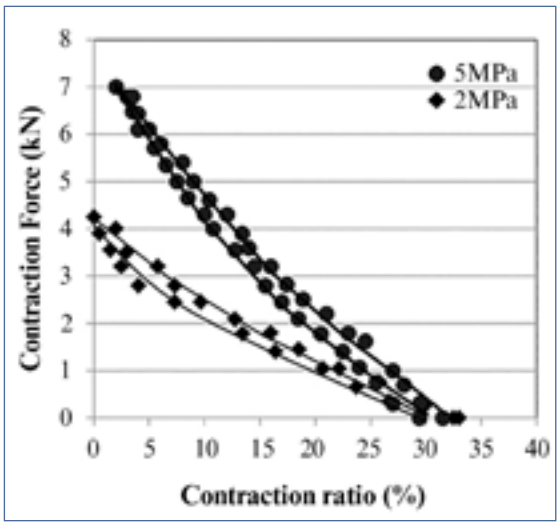


Figure 3: A summary of the operational characteristics of the artificial muscle: outer diameter, 15 mm; maximum contractile force, 7.0 kN; maximum shrinkage rate 30%.

by the researchers can be used in hydraulic pressure drives and is operable at a pressure of 5.0 MPa, which is much higher than conventional McKibben type artificial muscles. It is, therefore, possible to generate a significantly higher amount of power with the muscle developed in this research.

The research team has developed a new rubber material that has excellent oil resistance and deformation characteristics. In addition the method for weaving the high-tension chemical fibres has been modified and a technique for connecting the tube ends has been developed so that high pressures can be accommodated. As a result, an innovative, lightweight, and highly powerful artificial muscle with excellent pressure resistance and oil resistance has been realised, which is capable of converting high hydraulic pressure into efficient power generation. It is an innovative actuator with a 'strength-to-weight ratio' that is five to ten times greater than conventional electric motors and hydraulic cylinders.

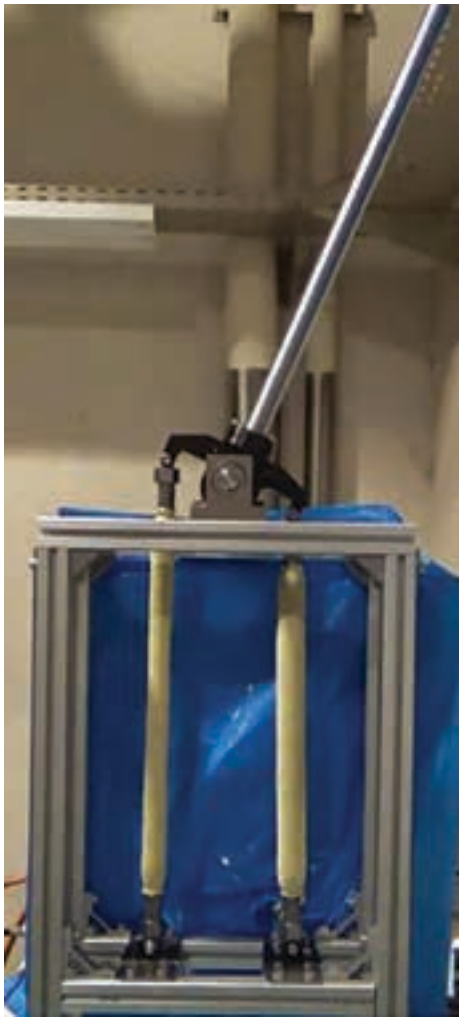
Figure 4: Application to the robot arm. ***Right:*** *two robotic arms using the artificial muscle.* ***Below:*** *A wrist of a robot with six artificial muscles.*

The artificial muscle developed in this research (shown in Figure 2) consists of a rubber tube surrounded by a woven sleeve, thus it is highly resistant to strong external shocks and vibrations. It is expected to lead to tough robots that can handle work where shocks loading is common – making holes in walls using an impact drill, chipping concrete walls, etc – which is difficult for existing robots driven by electric motors to handle.

Future development

The researchers will now go on to develop robots that are able to use this artificial muscle with the intention of contributing to the advancement of robot deployment for a safe and secure society. In addition, they are aiming to achieve higher performance and to help spread its use and development as a consumer-use robot actuator. ❑

Reference: *The Cabinet Office: Impulsing Paradigm Change through Disruptive Technologies Programme (ImPACT); programme manager: Satoshi Tadokoro.*



Australian packaging partners with SA manufacturers

With 35 years' experience and over 300 installations worldwide, HMPS is the largest case packing and palletising machinery builder in Australia. The company's machinery is exported to Asia, South Africa, New Zealand, Europe and the USA. This article looks at a new partnership between the Australian office and various manufacturers in South Africa.

Mark Emmett, managing director of Australia-based HMPS.

HMPS, an Australian company which specialises in the design, development and manufacturing of high quality machinery for packaging processes, set up office in South Australia a result of the key wine industry in that region. The company was responsible for designing and developing the first 'Bag in Box' machinery back in the '80s and has since grown to offer case packers (including RSC), palletisers, carton erectors and sealers, pick and place applications and specialised robotic solutions.

"With South Africa and Australia having similar industries, especially the fruit growers and the wine and food industries, there are many similarities to be drawn," says Mark Emmett, managing director of HMPS, which has recently installed machinery at various manufacturers in South Africa.

HMPS was recently awarded the contract for the installation of its HMPS1000 RSC 'Bag in Box' (BIB) Case Packer and System Integration solution at an international food and beverage company. The large dairy producer required the machine to erect, load and seal cartons of cream cheese.

HMPS had to work to specific customer requirements and the HMPS machine had to be integrated with two other machines from separate suppliers – a Vertical Form Filled Seal (VFFS) machine and a pumping dosing unit containing a lance, which would fill the cheese into the bag.

Emmett explains that the intricacy of this machine is in the way the bag is filled. "This particular machine places the bag into the box and then fills it once in the carton, and not the other way round."

Due to the shape of the carton, which is not a standard size, it was difficult to place a filled bag into the box. "With processed cheese there should be no air bubbles in it, and the bag needs to be filled fully with high temperature cheese in a way that will allow it to set in the correct size and shape during transit. Once filled, it is difficult to fit a bag of processed cheese into a carton as the cheese immediately starts to set and takes on the shape of the bag, and not the carton," adds Emmett.

Using a servo-controlled indexing system and a verification sensor, the carton erector places and orients the carton for filling.

The lance used in this process had the advantage that it could start filling the bag from the bottom, and move up as it started filling meaning no air bubbles and no splashing. The speed of the pump could also be varied. The result is a completely square block of cheese without air bubbles easy to cut into the required blocks.

HMPS designs and builds in accordance with the OH&S requirements of the country it is servicing, so international customers can be assured that the machinery will meet the local standards requirements.

Emmett says that even smaller manufacturers have the opportunity to automate processes to increase productivity and provide a safer and more hygienic working environment. ❑

Africa Automation Fair 2017

The 2017 Africa Automation Fair (AAF), a focused networking platform for the automation and control Industry, is to be held at the Ticketpro Dome in North Riding, Johannesburg from 6 to 8 June, 2017.

In line with the growing international focus on Industry 4.0 and industries of the future, a high-level Connected Industries conference will also be hosted. AAF 2017 will be the platform where industrial automation and the digital revolution converge and where operations technology and information technology blend together to become more intelligent.

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Industry diary

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