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SAIEE THE OFFICIAL PUBLICATION OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | **SEPTEMBER 2015**

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wattnow

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6076

September sees us featuring Robotics & Automation. Is this the way of the future? I'm sure that manufacturing plants will shortly, if they haven't already, automate their factories due to various economical and political reasons.

This issue of **watt**now sports a jam-packed issue filled with great content. I have a few news pieces on Robotics, which is very interesting to see the development in robotics worldwide.

We kick off the feature articles with 6 of the strangest robots ever created. Some of them are truly creepy, and then others are just mindboggling.

Bennett Brumson focuses on material removing robots, which you will find on page 26. With incessantly high prices worldwide, manufacturing plants are taking a closer look in cost reduction in wastages.

The fist-clencher on page 30, written by Brent Balinski tackles "Automation; the enemy of employment?" Major companies agree that automation is the way of the future, but at what cost to the employment figure?

Page 36 sees Jim Pinto, a industrial automation specialist, sharing with us his views on the history, current affairs and future of industrial automation.

I would urge our members to actively recruit a new member to the SAIEE. You will receive 20% off your 2016 membership fees for each new member. If you recruit 5 new members, and they qualify, you will receive your 2016 membership for free!! An opportunity not to be missed. The closing date for this membership drive is 31 October 2015.

Herewith your September issue - enjoy the read.

Minx

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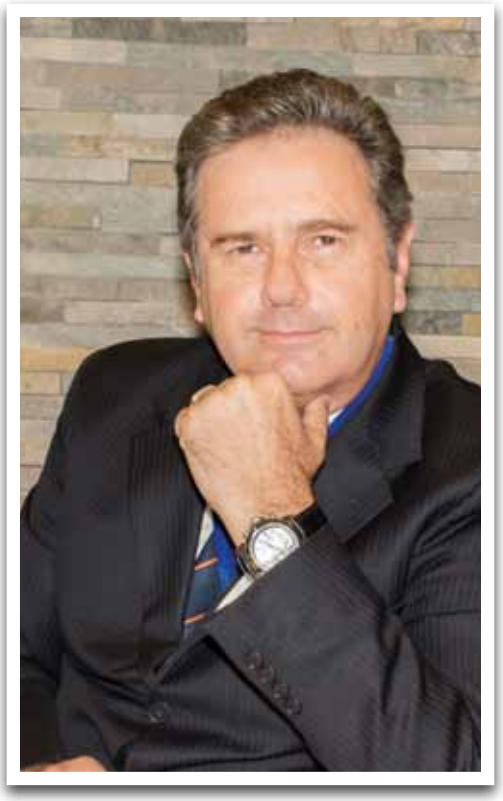


André Leo Hoffmann
2015 SAIEE President

Warm greetings from a windy Johannesburg.

Spring is upon us here in the Southern Hemisphere. Can you feel the sap rising in your legs to rejuvenate and give new strength and growth, hopefully bringing a sense of hope an anticipation of new things?

Robotics and Automation conjure up either excitement or fear in many people. The evolution of Robots (and I don't mean the traffic signal systems) is fast approaching viably emulating autonomous human behaviour.

Ever since early man picked up the first rock to break open a seed pod for food, or found a use for a strong log to lever out a heavy object, mankind has fashioned tools from his surroundings. Using principles of physics and science made life easier. Naturally this has, over time, taken the form of an array of tools designed for defence, aggression, and protection, all the way to tools needed to build and sustain society as we know it today.

Robotics brings together an array of multidisciplinary specialities that include electrical, mechanical and computer sciences. It is indeed a convergence of principles and skills to create autonomous machines that will ultimately think for themselves and hopefully build a better future.

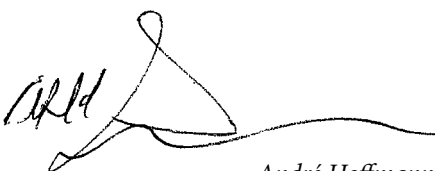
Artificial Intelligence (AI) has been described as a threat that could be 'more dangerous than nukes' so much so that a group of scientists and entrepreneurs, including Stephen Hawking and Elon Musk, have signed an open letter promising to ensure AI research benefits humanity. The letter warns that, without safeguards on intelligent machines, mankind could be heading for a dark future. This was communicated in a document drafted by the *Future of Life Institute*[1], and it said scientists should seek to head off risks that could wipe out mankind. The authors conclude that there is a 'broad consensus' that AI research is making good progress, and would have a growing impact on society.

Consideration needs to be given to things like the labour market - When, and in what order should we expect various jobs to become automated? How will this affect wages of less skilled workers, and information workers? Some have argued that AI is likely to greatly increase the overall wealth of humanity as a whole. However, increased automation may push income distribution further towards a power low, and the resulting disparity may fall disproportionately along lines of race, class, and gender. Significant parts of the economy, including finance, insurance, and many consumer markets, could be susceptible to disruption through the use of AI techniques to learn, model, and predict agent actions.

The development of systems that embody significant amounts of intelligence and autonomy leads to important legal and ethical questions, whose answers impact both producers and consumers of AI technology. These questions span law, public policy, professional and philosophical ethics, and will require expertise from computer scientists, legal experts, political scientists, and ethicists. For example the liability of a law for Autonomous Vehicles; Machine ethics; Autonomous weapons; Privacy etc.

It has been argued that very general and capable AI systems operating autonomously to accomplish some task, will often be subject to effects that increase the difficulty of maintaining meaningful human control. More importantly what the 'agenda' is of that human control.

Already this year we have had some deaths of factory workers caused by machines in a car factory in Germany and more recently in India. Let us hope the influencers can be effective in building a society in which we actually want to live. We wouldn't want to 'summon the demon' as Elon Musk puts it.



André Hoffmann
Pr. (Tech.) Eng | FSAIEE

[1] *http://futureoflife.org/AI/open_letter*

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The SAIEE is offering all current members the opportunity to qualify for free membership in 2016!

For every engineering colleague you recruit, who is NOT an SAIEE member, and they become a member, you will receive 20% off your membership fees. If you recruit 5 engineers, you will receive your 2016 membership fees totally free of charge!

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WATTSUP

FESTO supports the Sci-Bono Lab

FESTO, a global leader in industrial automation and technical education, partnered with the Sci-Bono Discovery Centre to launch the Mechatronics Lab on Tuesday, 4 August in Newtown.

FESTO donated two million rand worth of training equipment towards the facility. The Sci-Bono lab is a Mechatronics Engineering Training System/Lab for secondary schools. It will address manufacturing, employability and STEM subjects (Science, Technology, Engineering and Mathematics). The hope is that this facility will improve the human resources needed to drive the industrial manufacturing core of the South African economy by closing the skills gap, improving employability and increasing productivity.

"FESTO is both industry and education. We focus on building skills as much as we focus on building industrial productivity. We take industrial technology and put it into the classroom. We see the partnership with Sci-Bono as particularly valuable to address the secondary school market to increase the number of learners with maths, science and technology so we get more engineers and artisans who are the technology core of the country and therefore the future of the country," says Horst Weinert, FESTO Manager – Didactic Southern/Eastern Africa.

This state of the art facility, which launched during National Science Week, is suitable for Grade 10-12 learners and will provide training and guidance to support technical curriculum development.

The lab is equipped with learning systems that makes industry-relevant technology easy to use in the classroom, e.g. bionics, pneumatics, electrics, 3D printing, robotics and mechatronics kits that are hands-on, fun and simple to build and prototype, ensuring learning-by-doing, culminating in the assembly and fault-finding of a small manufacturing factory with similar processes and components to what would be found at industrial production lines. This adds fascination to the theory of maths, science and technology subjects, informs career choices and promotes employability by bridging the gap between industry and education.

Horst Weinert
FESTO Manager
Didactic Southern/Eastern Africa

The FESTO Sci-Bono Mechatronics lab is located on the corner of Miram Makeba and President Streets, Newtown Johannesburg.

ZEST Weg Group introduces the latest advances in Electric Motor Control

The continuous pursuit for improvement and cost reduction in industry has seen a rapid evolution in the development of electric motor control and protection systems. *"To ensure that we meet all the needs of industry in this regard, as well as keeping abreast of the latest trends and developments, the Zest WEG Group has introduced the WEG range of RW_E electronic motor protection overload relays, to complement the range of smart relays"* Stephen Cook, switchgear manager at Zest WEG Group, says.

The WEG RW_E electronic overload relay is designed for increased reliability in terms of the protection of low voltage three phase motors in sinusoidal 50/60 Hz networks where reliability, low power dissipation and ease of maintenance are critical requirements. The WEG RW_E electronic overload relay has been developed in accordance with the IEC 60947-4-1 and UL 60947-4-1A (UL 508) international standards.

RW_E Electronic overload relays are highly reliable devices intended to protect motors, controllers and branch circuit conductors against phase failures and overloads that can result in overheating. These critical products play a vital role in overall system performance and efficiency and are designed to protect three phase and single phase AC motors.

The electronic overload relay has no power contacts and therefore cannot disconnect the motor by itself. Instead, motor overloads or phase failures increase the motor current, which in turn trips the mechanism and switches the auxiliary contacts. When wired properly in series with the coil of the contactor, these auxiliary contacts will de-energise the contactor in the event of an overload.

This means the contactor itself disconnects

City Power - first purchaser of ACTOM MV Switchgear's new AMV12's

ACTOM MV Switchgear technicians completing assembly and inspection of the AMV12 switchgear panel for City Power's Industria substation

City Power is ACTOM MV Switchgear's first customer for its new generation AMV12 range of air-insulated switchgear officially launched into the market at the beginning of the year.

The business unit was awarded a contract in April last year to provide a 17-panel 12 kV rated switchboard incorporating the new switchgear for installation in the 88 kV/11 kV Industria substation in Industria, west of Johannesburg's city centre.

The contract, which formed part of a refurbishment and upgrade of the substation by City Power, was awarded by Midrand-based Machite Engineering, the electrical and civils contractor on the project.

ACTOM MV Switchgear, which completed the contract in January this year, developed the AMV12 range in line with the changing requirements of its principle customers and in conformity with the latest international quality and safety standards. It developed the new range in partnership with YIHE Electric Group, a Qingdao (China) based manufacturer of electrical equipment.

The AMV12 range of switchgear is rated for 12 kV with current ratings of 800 A, 1250 A and 2500 A at 31,5 kA in accordance with IEC 62271-200.

ACTOM MV Switchgear has subsequently received several more orders from other key customers, including CONCO, DRA and the City of Windhoek.

and Protection Systems

the power supply to the motor, halting its operation. Another handy feature is that, once tripped, the relay will only reset once the motor has cooled down, preventing costly damage. The WEG RW_E electronic overload relays are temperature compensated, which means that the trip point is not affected by temperature and it performs consistently at the same current value.

In order to ensure rapid tripping in the case of phase loss, and thereby protecting the motor and avoiding costly repairs or additional maintenance, the WEG RW_E relays include phase failure sensitivity protection as a standard feature. They can be mounted directly onto the WEG CWB and CWM contactor ranges which make for highly reliable and flexible motor starting units.

The WEG family of smart relays includes the WEG SRW product with HMI and fieldbus capability and Profibus, Modbus and Ethernet.

The WEG RW_E electronic overload relay is designed for increased reliability.

WATTSUP

The South African Institute of Lighting (SAIL) represents all that is new and at the forefront of Lighting in the built environment in South Africa.

The initiative was formed when patrons of the lighting industry recognised a need for an organisation that provided a variety of both tangible and intangible benefits including:

- Up-to-date legislative information from SABS, the NRCS and government that was relevant to a variety of areas of focus in the lighting industry.
- Focus on individual lighting career path development
- Access to online lighting courses based on a building block principle to advance lighting knowledge and proficiency
- Access to an array of industry events including: Monthly meetings, monthly breakfasts, Q & A sessions, Educational panels sessions, professional speakers, satellite events, golf days, network events, online seminars, showcase events as well as affiliate organisations events. This will provide valuable exposure to a variety professionals within the built environment.
- This will all be achieved through a modern framework making use of a variety of digital touch points including a members' portal on the website, peer-to-peer social media (Facebook and linked In), access to downloads, email notifications, meeting invitations, access to current information and international happenings in the lighting industry.
- Members will have access to a variety of free relevant built environment publications

SAIL's main goal is to provide real benefits to the members. Membership is open to all professionals working in the built environment including lighting professionals, contractors, architects, electrical engineers, interior designers, facility managers, students, artists and more… The primary focus of the organisation is to provide current information from a variety of areas including but not limited to: Exterior lighting, interior Lighting, Décor Lighting, Artistic Lighting, Stage Lighting, Commercial Lighting, Retail Lighting, Industrial Lighting, Hazardous Area Lighting, and Street Lighting.

The main objective of its committee is to provide transparent objective comment and information that adds benefit to their members' career paths. At only R500 per year for membership, the free publications alone more than make up the expense. Group membership is recognised for companies when 3 or more individual members apply for membership, each individual member would then receive a R20 discount.

We believe that rather than networking within our lighting industry, that success is born from networking within the greater built environment. What we see from our initial efforts is that SAIL is set to transform the way professionals see lighting in the built environment and indeed how lighting practitioners execute professional lighting projects and designs.

A Safer Soccer Experience with Vuvu-Lyza

In South Africa, soccer and vuvuzelas goes hand-in-hand. Castrol and Ogilvy Cape Town worked hand-in-hand to create vuvuzelas with a multi-purpose; offering fun and enjoyment at soccer games and also ensuring drivers arrive home safely.

The breathalyzer test is the most commonly used method for alcohol testing, but can be extremely invasive. Castrol combined the breathalyzer that everybody hates and the vuvuzela that everybody loves to create the Castrol Vuvu-Lyza. This innovative invention is giving drivers who love soccer a safer experience after a night out. After the game, drivers simply blow their Vuvu-Lyza and green means go and red means that they are above the legal drinking limit and should not drive.

"We are so proud of this safety initiative inspired by something so synonymous with our local football culture. We are sure the Vuvu-Lyza will be a hit once it becomes available to public", said Pooja Desai, Passenger Car Oils Manager of Castrol South Africa.

More space in the distribution board with DEHN

Lightning and surge protection experts, DEHN AFRICA, has launched the coordinated type 1 DEHNbloc Maxi 1 CI 440 FM and DEHNbloc Maxi 1 CI 760 FM surge protective devices (SPD). These have been specifically designed for higher system voltages, thus ensuring efficient protection against direct and indirect lightning currents in various industrial applications.

The devices require up to 60 percent less space than a conventional solution with an external backup fuse. In addition, the user does not have to be concerned about the correct dimensioning of the backup fuse as it is already integrated in the device, and is therefore adapted to the performance parameters of the surge protection components of the type 1 SPD.

The impulse-current-resistant fuse is optimised for discharging lightning currents of 10/350 µs wave form. Within the device, a spark gap is used which has a high mains follow current extinguishing capability in case of higher system voltages up to 760 V AC. Thus, power-frequency follow currents are significantly limited and extinguished within a few milliseconds.

The operating-current-free status / fault indication of DEHNbloc Maxi 1 CI also monitors the integrated backup fuse and indicates its status. In addition to the standard visual indication with green and red indicator flags, the device features a dry contact remote signalling terminal. With its floating changeover contact, the remote signalling contact can be used as a break or make contact according to the particular circuit concept.

The DEHNbloc Maxi 1 CI 440 FM and DEHNbloc Maxi 1 CI 760 FM provide significant space savings compared to conventional solutions with separate SPD and backup fuse

Innopro Contributes To African Lightning Safety And Protection

Innopro directors Ian McKechnie and Ian Jandrell recently participated in, and contributed to, the 2nd African Centres for Lightning and Electromagnetics (ACLE) International Symposium: "Strategic Interventions to Mitigate the Hazard of Lightning". Both Ian McKechnie and Ian Jandrell are appointed as Research Advisors to the ACLE.

McKechnie, also an Honorary Research Fellow at the University of the Witwatersrand, commented that *"it was a pleasure to again have the opportunity to participate in the ACLE activities and to make a meaningful contribution towards lightning safety and protection on the African continent"*.

Ian Jandrell, who is the Dean of the Faculty of Engineering and the Built Environment, and CBI-electric Professor of Lightning, at the University of the Witwatersrand (Wits), noted that the opportunity was also used to initiate links between Wits and the University of Zambia and to start exploring the possibility of joint skills development activities in this space. Jandrell also made a formal presentation to the symposium on the "Physics of lightning".

Held from 11-13 August 2015 in Lusaka, Zambia, the event also saw the launch of the Zambian national ACLE centre. ACLE is a pan-African network dedicated to decreasing deaths, injuries and property damage due to lightning. The symposium and ACLE are supported and facilitated by the Non-Aligned Movement (NAM) Science and Technology Centre, and the NAM S&T director general Prof. Dr Arun Kulshreshtha was also present, along with ACLE founding director Prof Mary Ann Cooper. The ACLE is hosted at the Makarere University in Kampala, Uganda.

From left: Ms Foster Lubasi (Coordinator at ACLE-Zambia), Ian McKechnie (Innopro/Wits), Prof. Mohd Zainal Abidin Ab Kadir (Deputy Dean (Research & Innovation) Universiti Putra Malaysia), Prof Ian Jandrell (Wits/ Innopro), Prof Mary Ann Cooper MD (Founding Director ACLE).

McKechnie concluded by thanking the NAM S&T Centre for the continued guidance and support given to the ACLE and its symposiums.

MIT cheetah robot lands the running jump

In a leap for robot development, the MIT researchers who built a robotic cheetah have now trained it to see and jump over hurdles as it runs — making this the first four-legged robot to run and jump over obstacles autonomously.

BY | JENNIFER CHU **|** MIT NEWS OFFICE

To get a running jump, the robot plans out its path, much like a human runner: As it detects an approaching obstacle, it estimates that object's height and distance. The robot gauges the best position from which to jump, and adjusts its stride to land just short of the obstacle, before exerting enough force to push up and over. Based on the obstacle's height, the robot then applies a certain amount of force to land safely, before resuming its initial pace.

In experiments on a treadmill and an indoor track, the cheetah robot successfully cleared obstacles up to 18 inches tall — more than half of the robot's own height — while maintaining an average running speed of 5 miles per hour.

"A running jump is a truly dynamic behaviour," says Sangbae Kim, an assistant professor of mechanical engineering at MIT. *"You have to manage balance and energy, and be able to handle impact after landing. Our robot is specifically designed for those highly dynamic behaviours."*

See, run, jump

Last September, the group demonstrated that the robotic cheetah was able to run untethered - a feat that Kim notes the robot performed "blind," without the use of cameras or other vision systems.

Now, the robot can "see," with the use of onboard LIDAR — a visual system that uses reflections from a laser to map terrain. The team developed a three-part algorithm to plan out the robot's path, based on LIDAR data. Both the vision and path-planning system are onboard the robot, giving it complete autonomous control.

The algorithm's first component enables the robot to detect an obstacle and estimate its size and distance. The researchers devised a formula to simplify a visual scene, representing the ground as a straight line, and any obstacles as deviations from that line. With this formula, the robot can estimate an obstacle's height and distance from itself.

Once the robot has detected an obstacle, the second component of the algorithm kicks in,

allowing the robot to adjust its approach while nearing the obstacle. Based on the obstacle's distance, the algorithm predicts the best position from which to jump in order to safely clear it, then backtracks from there to space out the robot's remaining strides, speeding up or slowing down in order to reach the optimal jumping-off point.

This "approach adjustment algorithm" runs on the fly, optimizing the robot's stride with every step. The optimization process takes about 100 milliseconds to complete — about half the time of a single stride.

When the robot reaches the jumping-off point, the third component of the algorithm takes over to determine its jumping trajectory. Based on an obstacle's height, and the robot's speed, the researchers came up with a formula to determine the amount of force the robot's electric motors should exert to safely launch the robot over the obstacle. The formula essentially cranks up the force applied in the robot's normal bounding gait, which Kim notes is essentially "sequential executions of small jumps."

Optimal is best, feasible is better

Interestingly, Kim says the algorithm does not provide an optimal jumping control, but rather, only a feasible one.

"If you want to optimize for, say, energy efficiency, you would want the robot to barely clear the obstacle — but that's dangerous, and finding a truly optimal solution would take a lot of computing time," Kim says. *"In running, we don't want to spend a lot of time to find a better solution. We just want one that's feasible."*

Sometimes, that means the robot may jump much higher than it needs to — and that's OK, according to Kim: *"We're too obsessed with optimal solutions. This is one example where you just have to be good enough, because you're running, and have to make a decision very quickly."*

The team tested the MIT cheetah's jumping ability first on a treadmill, then on a track. On the treadmill, the robot ran tethered in place, as researchers placed obstacles of varying heights on the belt.

As the treadmill itself was only about 4 meters long, the robot, running in the middle, only had 1 meter in which to detect the obstacle and plan out its jump. After multiple runs, the robot successfully cleared about 70 percent of the hurdles.

In comparison, tests on an indoor track proved much easier, as the robot had more space and time in which to see, approach, and clear obstacles. In these runs, the robot successfully cleared about 90 percent of obstacles.

Kim is now working on getting the MIT cheetah to jump over hurdles while running on softer terrain, like a grassy field. This research was funded in part by the Defense Advanced Research Projects Agency. wn

New 'deep learning' technique enables robot mastery of skills via trial and error

University of California, Berkeley researchers have developed algorithms that enable robots to learn motor tasks through trial and error using a process that more closely approximates the way humans learn, marking a major milestone in the field of artificial intelligence.

hey demonstrated their technique, a type of reinforcement learning, by having a robot complete various tasks - putting a clothes hanger on a rack, assembling a toy plane, screwing a cap on a water bottle, and more - without pre-programmed details about its surroundings.

Video shows BRETT, a PR2 robot, learning various motor tasks through trial and error. BRETT uses the same "deep learning" algorithm to master all tasks.

"What we're reporting on is a new approach to empowering a robot to learn," said Professor Pieter Abbeel of UC Berkeley's Department of Electrical Engineering and Computer Sciences. *"The key is that when a robot is faced with something new, we won't have to reprogram it. The exact same software, which encodes how the robot can learn, was used to allow the robot to learn all the different tasks we gave it."*

Abbeel is leading the project with fellow UC Berkeley faculty member Trevor Darrell, director of the Berkeley Vision and Learning Center. Other members of the research team are postdoctoral researcher Sergey Levine and Ph.D. student Chelsea Finn.

The work is part of a new People and Robots Initiative at UC's Center for Information Technology Research in the Interest of Society (CITRIS). The new multi-campus, multidisciplinary research initiative seeks to keep the dizzying advances in artificial intelligence, robotics and automation aligned to human needs.

"Most robotic applications are in controlled environments where objects are in predictable positions," said Darrell. *"The challenge of putting robots into real-life settings, like homes or offices, is that those environments are constantly changing. The robot must be able to perceive and adapt to its surroundings."*

Conventional, but impractical, approaches to helping a robot make its way through a 3D world include pre-programming it to handle the vast range of possible scenarios or creating simulated environments within which the robot operates.

Instead, the UC Berkeley researchers turned to a new branch of artificial intelligence known as deep learning, which is loosely inspired by the neural circuitry of the human brain when it perceives and interacts with the world.

"For all our versatility, humans are not born with a repertoire of behaviors that can be deployed like a Swiss army knife, and we do

BRETT is shown here learning how to screw a cap onto a water bottle. (Photo courtesy of UC Berkeley Robot Learning Lab)

not need to be programmed," said Levine. *"Instead, we learn new skills over the course of our life from experience and from other humans. This learning process is so deeply rooted in our nervous system, that we cannot even communicate to another person precisely how the resulting skill should be executed. We can at best hope to offer pointers and guidance as they learn it on their own."*

In the world of artificial intelligence, deep learning programs create "neural nets" in which layers of artificial neurons process overlapping raw sensory data, whether it be sound waves or image pixels. This helps the robot recognize patterns and categories among the data it is receiving. People who use Siri on their iPhones, Google's speech-to-text program or Google Street View might already have benefited from the significant advances deep learning has provided in speech and vision recognition.

Applying deep reinforcement learning to motor tasks has been far more challenging, however, since the task goes beyond the passive recognition of images and sounds.

"Moving about in an unstructured 3D environment is a whole different ballgame," said Finn. *"There are no labeled directions, no examples of how to solve the problem in advance. There are no examples of the correct solution like one would have in speech and vision recognition programs."*

In the experiments, the UC Berkeley researchers worked with a Willow Garage Personal Robot 2 (PR2), which they nicknamed BRETT, or Berkeley Robot for the Elimination of Tedious Tasks.

They presented BRETT with a series of motor tasks, such as placing blocks into matching openings or stacking Lego blocks. The algorithm controlling BRETT's learning included a reward function that provided a score based upon how well the robot was doing with the task.

BRETT takes in the scene, including the position of its own arms and hands, as viewed by the camera. The algorithm provides real-time feedback via the score based upon the robot's movements. Movements that bring the robot closer to completing the task will score higher than those that do not. The score feeds back through the neural net, so the robot can learn which movements are better for the task at hand.

This end-to-end training process underlies the robot's ability to learn on its own. As the PR2 moves its joints and manipulates objects, the algorithm calculates good values for the 92,000 parameters of the neural net it needs to learn.

With this approach, when given the relevant coordinates for the beginning and end of the task, the PR2 could master a typical assignment in about 10 minutes. When the robot is not given the location for the objects in the scene and needs to learn vision and control together, the learning process takes about three hours.

Abbeel says the field will likely see significant improvements as the ability to process vast amounts of data improves.

"With more data, you can start learning more complex things," he said. *"We still have a long way to go before our robots can learn to clean a house or sort laundry, but our initial results indicate that these kinds of deep learning techniques can have a transformative effect in terms of enabling robots to learn complex tasks entirely from scratch. In the next five to 10 years, we may see significant advances in robot learning capabilities through this line of work."* wn

Tough tail of a seahorse may provide robotic solutions

One of the ocean's oddest little creatures, the seahorse, is providing inspiration for robotics researchers as they learn from nature how to build robots that have capabilities sometimes at odds with one another – flexible, but also tough and strong.

heir findings, published in the journal Science, outline the virtues of the sea horse's unusual skeletal structure, including a tail in which a vertebral column is surrounded by square bony plates.

These systems may soon help create technology that offers new approaches to surgery, search and rescue missions or industrial applications.

Although technically a fish, the sea horse has a tail that through millions of years of evolution has largely lost the ability to assist the animal in swimming. Instead, it provides a strong, energy-efficient grasping mechanism to cling to things such as seaweed or coral reefs, waiting for food to float by that it can suck into its mouth.

At the same time, the square structure of its tail provides flexibility; it can bend and twist, and naturally returns to its former shape better than animals with cylindrical tails. This helps the sea horse hide, easily bide its time while food floats to it, and it provides excellent crushing resistance - making the animal difficult for predators to eat.

"Human engineers tend to build things that are stiff so they can be controlled easily," said Ross Hatton, an assistant professor in the College of Engineering at Oregon State University, and a co-author on the study. *"But nature makes things just strong enough not to break, and then flexible enough to do a wide range of tasks. That's why we can learn a lot from animals that will inspire the next generations of robotics."*

Hatton said biological systems can combine both control and flexibility, and researchers gravitated to the sea horse simply because it was so unusual. They theorized that the square structure of its tail, so rare in nature, must serve a purpose.

"We found that this square architecture provides adequate dexterity and a tough resistance to predators, but also that it tends to snap naturally back into place once it's been twisted and deformed," Hatton said. *"This could be very useful for robotics applications that need to be strong, but also energy-efficient and able to bend and twist in tight spaces."*

Such applications, he said, might include laparoscopic surgery, in which a robotic device could offer enhanced control and flexibility

Skeleton of Sea Horse

as it enters a body, moves around organs and bones, and then has the strength to accomplish a surgical task. It could find uses in industrial system, search and rescue robots, or anything that needs to be both resilient and flexible.

The researchers were able to study the comparative merits of cylindrical and square structures by using computer models and three-dimensional printed prototypes. They found that when a sea horse tail is crushed, the bony plates tend to slide past one another, act as an energy absorbing mechanism, and resist fracture of the vertebral column. They can then snap back to their normal position with little use of energy.

The square system also proved to be stiffer, stronger and more resilient than circular ones.

"Understanding the role of mechanics in these biologically inspired designs may help engineers to develop sea horse-inspired technologies for a wide variety of applications in robotics, defence systems or biomedicine," the researchers wrote in their conclusion. wn

Local Manufacturer eases our lives daily

In the industrial area of Retreat in Cape Town's deep south sits a large (9000m²) but unassuming factory, whose slumbering façade belies a hive of activity on the inside, and whose output touches your life in a dozen secret and remarkable ways, probably on a daily basis.

To be allowed onto the factory floor of Grand Tellumat Manufacturing (GTM) is like entering a Silicon Valley blockbuster. All around are eerily identical technicians in white lab coats and antistatic protection, busily overseeing automated production lines doing rapid-fire, precise electronic component placements as well as manual product assembly, testing, quality checks and packing.

What they're pumping out in various parallel production lines might just blow your mind. *"In a busy month, we've made tens of thousands of LED TVs for the likes of Sony and other global brands,"* says Murison Kotzé, managing executive of GTM.

GTM is one of a very limited number of contract electronic manufacturers in South Africa with the capability to do this. What that means is that it engineers, industrialises, procures, assembles, tests and despatches thousands of products every month.

What's more, it does this for clients that are the electronic brands behind many of the products that automate, regulate, communicate and even protect your life every day.
"We manufacture and assemble on contract for a wide range of customers and brands – some of them competitors of one another – and that's why confidentiality and the protection of client intellectual property is paramount to us," continues Kotzé. *"We can however disclose that the factory manufactures computer monitors, digital commercial display units and TV units for home and office use. In addition, GTM assembles vehicle tracking units, used locally and exported internationally for security as well as fleet management purposes."*

Have you ever wondered who makes the boxes on street corners that manage 'robots' at traffic intersections? That's right, it's GTM.

The factory also makes a golf radar, used locally and internationally in golf pro shops and at driving ranges, for a US-based customer. The radar is used to test and trial new golf clubs and to assist with coaching. Whether outside at a range or indoors at a practice net, the device tracks club head speed, ball trajectory and the angle of the club face at impact (amongst other measures) – and, after some quick and clever calculations, displays it on a screen. This graphically shows the distance and trajectory a player would have hit the ball, whether he or she hit a 'draw' or 'fade', and how clean the strike was.

"We have also manufactured many electricity meters on behalf of our clients," says Kotzé. GTM continue to manufacture a number of military avionics devices like the IFF [Identification Friend or Foe] aircraft transponder, on behalf of our sister company Tellumat, that identifies friendly aircraft to other friendly ground, air or sea forces. In the commercial airspace, we manufacture satellite communication antennas which are now used on many commercial airliners.





GTM is also involved in the green energy sector where it has already produced components for solar energy farms on behalf of a German customer, and is presently busy with a similar localisation project for a US-based customer. And lastly, the company is the first true local manufacturer of slot machines in South Africa, thanks to the efforts of its majority shareholder Grand Parade Investments. *"Presently, machines are mostly fully imported into SA, but we contract manufacture and assemble limited payout machine cabinets for two international customers. We trust that soon, based on our local and B-BBEE credentials, we will be doing the same for many more slots OEMs."*

MAKING A NAME

That's some pretty cool stuff right in our own backyard, so why doesn't anyone know about it? Kotzé says the electronic contract manufacturing scene in South Africa is relatively small and unknown. *"Further, when you are manufacturing on behalf of a customer and its brand, the customer brand is the point of consumer interaction, so that is where the recognition should and does go. We provide a service to our customers that allows them to focus on product development and sales, and in so doing afford them the opportunity, once a product is developed, to not have to worry about manufacturing. Most companies get excited about developing and selling their ideas, the making is often what lets them down and that is where we come in with our engineering, sourcing and assembly expertise."*

But leaving aside GTM's contract electronic manufacturing focus, will we ever see a GTM-branded electronics goodie in our everyday lives?

"With our sister company Tellumat, we have developed our own set top box and hope to be a significant participant in South Africa's pending migration to digital TV, with a locally designed and manufactured unit," says Kotzé.

B-BBEE

Chances are they might just nail it. GTM is a joint venture between JSE-listed Grand Parade Investments Limited (51%) and defence and communications technology company Tellumat (Pty) Ltd (49%). The JV has significant B-BBEE credentials, offering value to local and international clients alike.

"Most major South African government procurement projects require a large percentage of local content. Added to this, the revised B-BBEE codes place an even larger emphasis on local procurement and enterprise development. This is done, in part, to enforce government's stated objective to drive job creation both directly and indirectly. GTM is perfectly positioned to provide this local content," says Kotzé.

ONE STOP SHOP

With a full turnkey service portfolio ranging from design to manufacturing, testing and post-manufacturing services, among others, and being able to handle volumes from prototyping phase to high volume runs, GTM further stands head and shoulders above other electronics manufacturers, which either do only product integration, surface mounting or other standalone services.

"We can take on someone with just an idea and, having the ability to take them from concept to a working proto-type, provide full manufacturing and ultimately facilitate the packaging and delivery of the product and even after sales support," he continues.

On the flipside GTM can just as easily provide any of the stand-alone services within the production cycle. wn

Virginia Tech researcher develops model for robots with bacterial brains

Forget the Vulcan mind-meld of the Star Trek generation — as far as mind control techniques go, bacteria is the next frontier.

Warren Ruder used a mathematical model to demonstrate that bacteria can control the behavior of an inanimate device like a robot.

In a paper published in Scientific Reports, a Virginia Tech scientist used a mathematical model to demonstrate that bacteria can control the behaviour of an inanimate device like a robot.

"Basically we were trying to find out from the mathematical model if we could build a living microbiome on a nonliving host and control the host through the microbiome," said Warren Ruder, an assistant professor of biological systems engineering in both the College of Agriculture and Life Sciences and the College of Engineering.

"We found that robots may indeed be able to function with a bacterial brain," he said. For future experiments, Ruder is building real-world robots that will have the ability to read bacterial gene expression levels in E. coli using miniature fluorescent microscopes. The robots do respond to bacteria he will engineer in his lab.

On a broad scale, understanding the biochemical sensing between organisms could have far reaching implications in ecology, biology, and robotics.

In agriculture, bacteria-robot model systems could enable robust studies that explore the interactions between soil bacteria and livestock. In healthcare, further understanding of bacteria's role in controlling gut physiology could lead to bacteria-based prescriptions to treat mental and physical illnesses. Ruder also envisions droids that could execute tasks such as deploying bacteria to remedy oil spills.

The findings also add to the ever-growing body of research about bacteria in the human body that are thought to regulate health and mood, and especially the theory that bacteria also affect behaviour.

The study was inspired by real-world experiments where the mating behaviour of fruit flies was manipulated using bacteria, as well as mice that exhibited signs of lower stress when implanted with probiotics.

Ruder's approach revealed unique decision-making behaviour by a bacteria-robot system by coupling and computationally simulating widely accepted equations that describe three distinct elements: engineered gene circuits in E. coli, microfluid bio-reactors, and robot movement.

The bacteria in the mathematical experiment exhibited their genetic circuitry by either turning green or red, according to what they ate. In the mathematical model, the theoretical robot was equipped with sensors and a miniature microscope to measure the colour of bacteria telling it where and how fast to go depending upon the pigment and intensity of colour.

The model also revealed higher order functions in a surprising way. In one instance, as the bacteria were directing the robot toward more food, the robot paused before quickly making its final approach - a classic predatory behaviour of higher order animals that stalk prey.

Ruder's study also demonstrates that these sorts of bio-synthetic experiments could be done in the future with a minimal amount of funds, opening up the field to a much larger pool of researchers.

Ruder conducted his research in collaboration with biomedical engineering doctoral student Keith Heyde, of Wilton, Connecticut, who studies phyto-engineering for biofuel synthesis.

"We hope to help democratize the field of synthetic biology for students and researchers all over the world with this model," said Ruder. *"In the future, rudimentary robots and E. coli that are already commonly used separately in classrooms could be linked with this model to teach students from elementary school through the Ph.D.-level about bacterial relationships with other organisms."* wn

6 Strangest Robots Ever Created

Whether or not you welcome our future robot overlords, there are some pretty bizarre machines that are already strutting their stuff. From a robotic snake that can slither or swim, to a giant Transformers-style contraption with "machine guns" for arms, here are some of the strangest robots that have ever been created.

BY | DENISE CHOW | LIVESCIENCE

SNAKE-BOT

The ACM-R5 is a snakelike robot that can crawl around on dry ground or swim through water. The amphibious bot, created by Japanese company HiBot, is equally fascinating and terrifying as it deftly twists and turns underwater.

KURATA ROBOT

In the world of robotics, some inventions are stranger than fiction. The massive Kurata robot could easily be mistaken for the made-believe machines in such Hollywood blockbusters as "Transformers" and "Real Steel."

The Japanese robot, made by Suidobashi Heavy Industry, stands a menacing 13-feet-

tall (4 meters), and is equipped with "machine guns" and "rocket launchers" in its arms (they're actually BB Guns and fireworks, which are still dangerous). These huge humanoid machines can be piloted manually from a cockpit inside the robot, or they can be controlled remotely using a smartphone.

Want your very own Kurata robot? These custom-built machines can be purchased for more than $1.35 million.

NAO ROBOT

French company Aldebaran Robotics, developed an autonomous and programmable robot named Nao. This interactive bot is equipped with cutting-edge motion, vision and audio capabilities. The Nao robot can walk on different surfaces, track and recognize faces and objects, express and understand emotions, and react to touch or voice commands. And if that's not enough, the robot can also do the Gangnam Style dance (yes, really).

BIGDOG

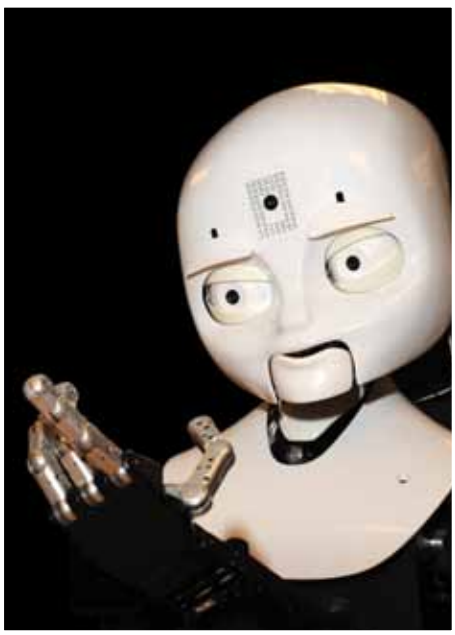
In 2005, the whizzes at Boston Dynamics created a four-legged robot, called BigDog, to serve as a robotic pack mule for the military. The project was funded by the Defense Advanced Research Projects Agency (DARPA), the branch of the U.S. Department of Defense tasked with developing new technologies for the military.

BigDog walks on four sturdy legs, and it can accompany soldiers across terrain deemed too rough for vehicles. The robot can lug 340 pounds (150 kilograms) of cargo and is capable of keeping up a pace of 4 mph (6.4 km/h).

H1N1 FLU ROBOT

It may not be what typically comes to mind when people think of "robots," but this humanlike contraption was designed to simulate the symptoms of the H1N1 (swine) flu to help train Japanese doctors. The robot, which is covered in material resembling human skin, can sweat, cry and even convulse. If the robots do not receive proper treatment, their symptoms

gradually get worse, and in some cases, they can even stop breathing and "die."



OCTAVIA

The U.S. Naval Research Laboratory's Octavia robot is a humanoid machine with perhaps some of the creepiest facial features. Octavia is a firefighting robot designed to help engineers test new technologies to assist members of the U.S. Naval Fleet.

Octavia is designed to interact with humans, and engineers are trying to develop ways for the robot to identify and track people, understand what humans say, and recognize any gestures they make. Eventually, scientists hope Octavia will be able to work shoulder-to-shoulder with human teammates, with sophisticated speech and visual recognition capabilities.

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MATERIAL REMOVAL ROBOTICS

Robots on the Grindstone

In an era of high prices for metals and energy, manufacturers are feeling the pinch. To ease the effect of increasing costs of these products, industry is taking a close look at ways of keeping energy and material expenses in line. Investing in robotics for material removal can be part of a mix of strategies to keep costs down by more efficiently using materials, time and energy.

BY | BENNETT BRUMSON

Many manufactures use material removal robotics for labour savings. Also, manufacturers see reductions in scrap parts, consumables and repetitive injury claims. These reductions can add up to significant savings," says Virgil Wilson, Senior Engineer for Material Removal with FANUC Robotics America Inc., Michigan.

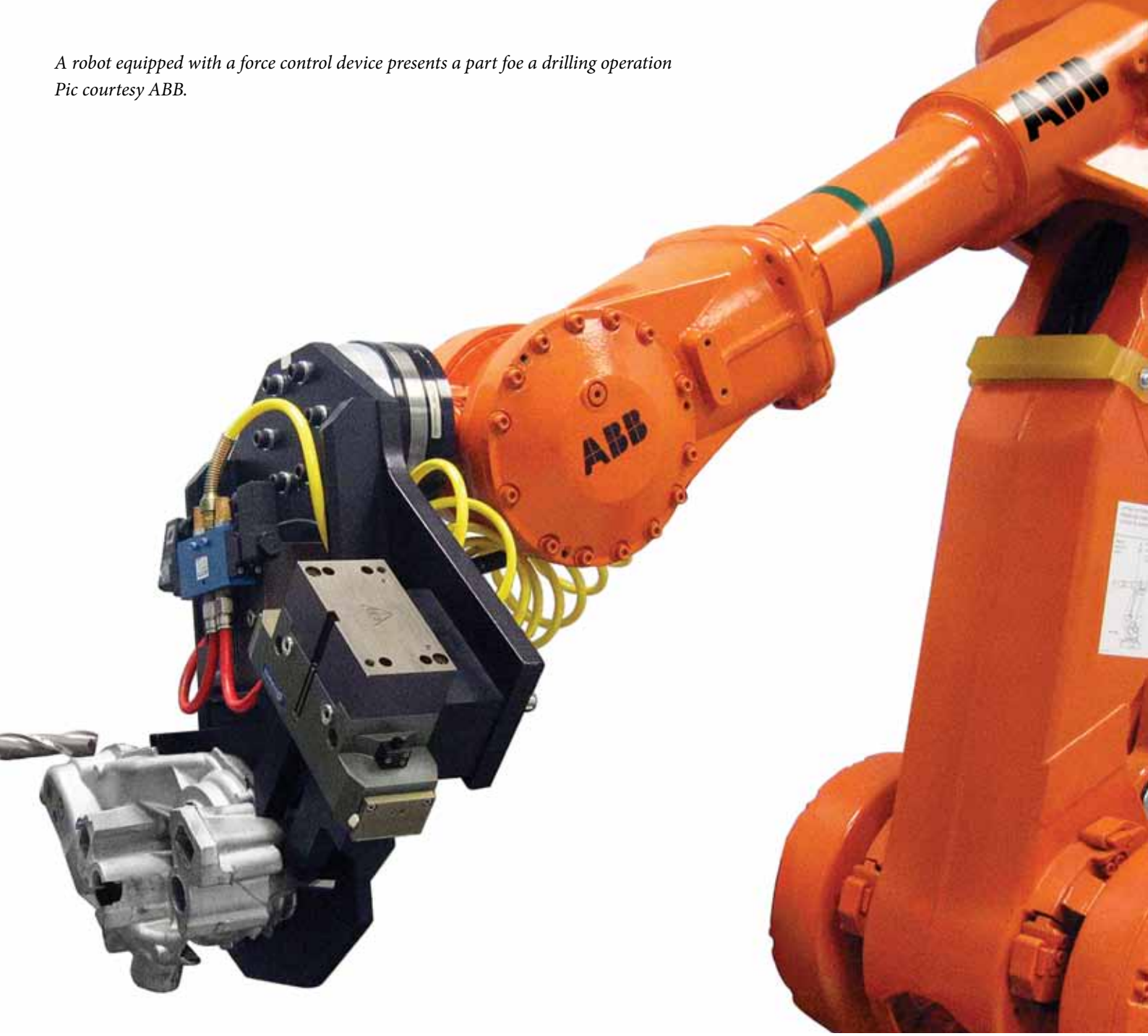
REMOVAL TASKS

Material removal processes, which include buffing, polishing, grinding, deburring, de-flashing, water-jet cutting, sanding, drilling and milling of manufactured parts, are difficult to do manually. With ergonomic risks, consistency issues and the high cost of materials, the flexibility that robots offer make for a wise investment.

"Robots used for material removal can be split into five different segments," asserts Roberta Zald, Director of Market Planning and Communications at KMT Robotic Solutions Inc., Auburn Hills, Michigan. "The largest segment, cutting and trimming, has the perimeter of parts and/or features cut by the robot."

The next largest segment involves "surface finishing

A robot equipped with a force control device presents a part foe a drilling operation
Pic courtesy ABB.



and polishing applications that have robots removing rough edges from a metal part after it is formed or smoothing the finish on metal castings or composites." Zald continues, "A third type of material removal is plastic edge finishing, which has robots cleaning up a rough parting line after the injection molding process."

According to Zald, the fourth largest category of material removal robotics is stripping-and-cleaning. Periodically the dimensional coating on parts used in products such as aircraft jet engines needs to taken off and reapplied. In addition, molds in some metal and composite molding processes need to be cleaned regularly.

Milling represents the fifth largest segment, according to Zald. Milling takes a block of material and creates a shape out of it. Unlike cutting and trimming where the part is already formed, robotic milling creates the shape of the part. This is the newest area of robotic material removal applications.

"When designing a robotic material removal work cell, integrators need to keep in mind that path performance is fundamental for a successful application.

When cutting holes into a plastic or metal part, accuracy of the path is important so you get circular hole rather than an oval hole," stresses Doug Niebruegge, Segment Manager for Foundry Applications at ABB Inc., Auburn Hills, Michigan. "Path performance is critical when doing material removal."

Robots on the Grindstone

continues from page 27

Milling robot in an enclosed work cell.

"In robotic surface finishing applications, knowing where the part is in space is vital for repeatability. Having a repeatable robot is necessary when de-flashing a cast part because knowing where the flash is and knowing how that flash can vary from part to part is important", Niebruegge adds.

Repeatability is a major concern to FANUC's Wilson, who contends that variability is an issue in material removal robotics. "Variability can come from several sources, such as robot repeatability, part repeatability, and process variability. Robot repeatability can range from 0.02 mm, for smaller robots to 0.40 mm for very large robots," reports Wilson. "This variance should be considered what is achievable in the part's finish requirements." In short, end-users cannot expect to achieve a finish tolerance that is less than the robot's repeatability, Wilson concludes.

In addressing part variability, Wilson says, "Variance can be substantial or insignificant, depending on the process. Sand cast parts usually have the most variance, while machined parts have the least." Wilson observes that, "Part variability can be addressed by using vision to measure the part's location relative to the robot."

Wilson turns his attention to process variability. "The size of the gate, flash, welds, and burrs are examples of process variability. To manage these variables, the system gives feedback to the robot to allow the robot to dynamically react to the process." Wilson suggests that using feedback from a force control sensor or from the spindle motor are among the strategies integrators use to deal with variability in the material removal process.

The complexity of parts that must be properly gripped in robotic material removal poses a challenge to integrators. "Some parts are difficult to grip because they have many contours," says Dominique Lalut, Operations Manager with Stäubli Corp., Duncan, South Carolina. "Precision is required for complex parts, particularly when the robot moves a lot within the work cell. Parts like watch bezels, medical implants, and aerospace turbine blades require a high-quality finish, without any nicks or grooves."

Deploying an appropriate robot for material removal tasks is another crucial consideration for integrators. "Many robots are not designed for the rigors of grinding or other material removal tasks that manipulate a tool over the part's surface or contours," says Greg Garmann, Software and Controls Technology Leader with Motoman Inc., West Carrollton, Ohio. Garmann believes in using a robust robot specifically designed with the rigidity needed for material removal applications.

"One challenge is finding the balance between process quality and cycle time," says Ted Warnecke, Senior Application Specialist at Motoman. "Testing is required to verify the material removal process and cycle time." Warnecke continues by saying, "Robotic material removal systems are often required to perform multiple tasks, including cutting and deburring or sanding and polishing. Integrators take one of two approaches: multiple spindles or spindles that can change material removal media or tools." The method used is generally determined by the process, maintains Warnecke.

Warnecke conveys a note of caution when he spells out a common error when setting up a material removal work cell. "Integrators must take into account the possibility that parts that can be in a different state than when finished." Warnecke illustrates his point by citing an example. "Parts that are still hot from a die cast or injection mold can cause process and fixturing problems. These problems stem from not selecting the proper combination of spindles, cutting tools or media to meet cycle time, tool life and process requirements of the work cell." An experienced and knowledgeable robot integrator is the best way to avoid these pitfalls.

REMOVED MATERIAL

Integrators must be mindful of managing the waste material when putting together material removal work cells. ABB's Niebruegge points out, "In the design of the material removal system, integrators need to make provisions for getting the waste out. Usually this is done by having the debris fall by gravity and channeled onto a conveyor that will take the waste away."

Detail of a milling robot's tool

KMT's Zald speaks of waste extraction in water-jet applications. "We have a method of using a high- volume vacuum that holds the part in position and removes the waste that is generated in water-jet cutting." Zald also mentions that as new materials are being developed for use by industry, new pressures arise to come up with material removal processes while also protecting workers and the environment.

FLEXIBILITY AND EFFICIENCY

The inherent flexibility of robotics is very apparent in material removal applications as other processes and procedures can be combined with it. "Material removal can be combined with part unloading, die casting, injection molding, blow molding, thermoforming, and deburring applications, if cycle time permits," says Warnecke of Motoman.

Likewise, "When the robot is polishing or deburring, we suggest having the robot carry the part so it can do additional operations like washing, cleaning, testing or palletizing," says Lalut of Stäubli. When possible, Lalut advises having the robot present parts undergoing material removal procedures to other machines for inspection, dispensing, and material handling. Combining different applications in a single work cell saves on cycle times and floor space.

In a similar vein, FANUC's Wilson believes material removal can be combined with other applications to add value to the manufacturing process. "During machine loading and unloading applications, the robot may have idle time between operations. This is a perfect time for a value-added application like material removal."

KMT's Zald observes that, "End-users want to add a material handling robot upstream, or dispense an adhesive for assembly tasks downstream from the material removal process." Similarly, "Material removal is often combined with material handling applications because it is very time-efficient to take the part to different abrasive tools to perform material removal," says ABB's Niebruegge, "By having an accurate and repeatable robot, fewer mistakes are made in the material removal process than if the task is performed manually. Fewer mistakes yield less scrap, which makes the production process more efficient and profitable.

Robots can help hold the line on consumable media costs. Stäubli's Lalut sketches out how robots help save on media use. "Robots use material removal media more consistently which leads to savings in sanding belts and grinding wheels as well as polishing and buffing paste." He states that when material removal is performed manually, people vary the amount of pressure they apply, which leads to an inconsistent finish on the part and a less-efficient use of consumable media. "A precise robot applies constant pressure on parts all of the time," Lalut affirms.

REMOVING ON

"The past few years have seen major advances in the robot's path performance so that it is able to follow a path very accurately. Also, the emergence of force control is making a big impact on material removal applications," remarks Niebruegge of ABB. "More advanced vision systems will look at a part and be able to tell the robot exactly where to remove material based on what the part looks like compared to what the part should look like."

Motoman's Warnecke also sees more powerful sensors that will perfect robotic material removal. "I expect to see additional development of software and control devices that perform surface finishing. This will include sensors to reliably answer how smooth or how shiny or a part 'feels' or 'looks.' These sensors will be able to avoid over-sanding or polishing parts and reduce the need for manual touch-ups after the automated process." WN

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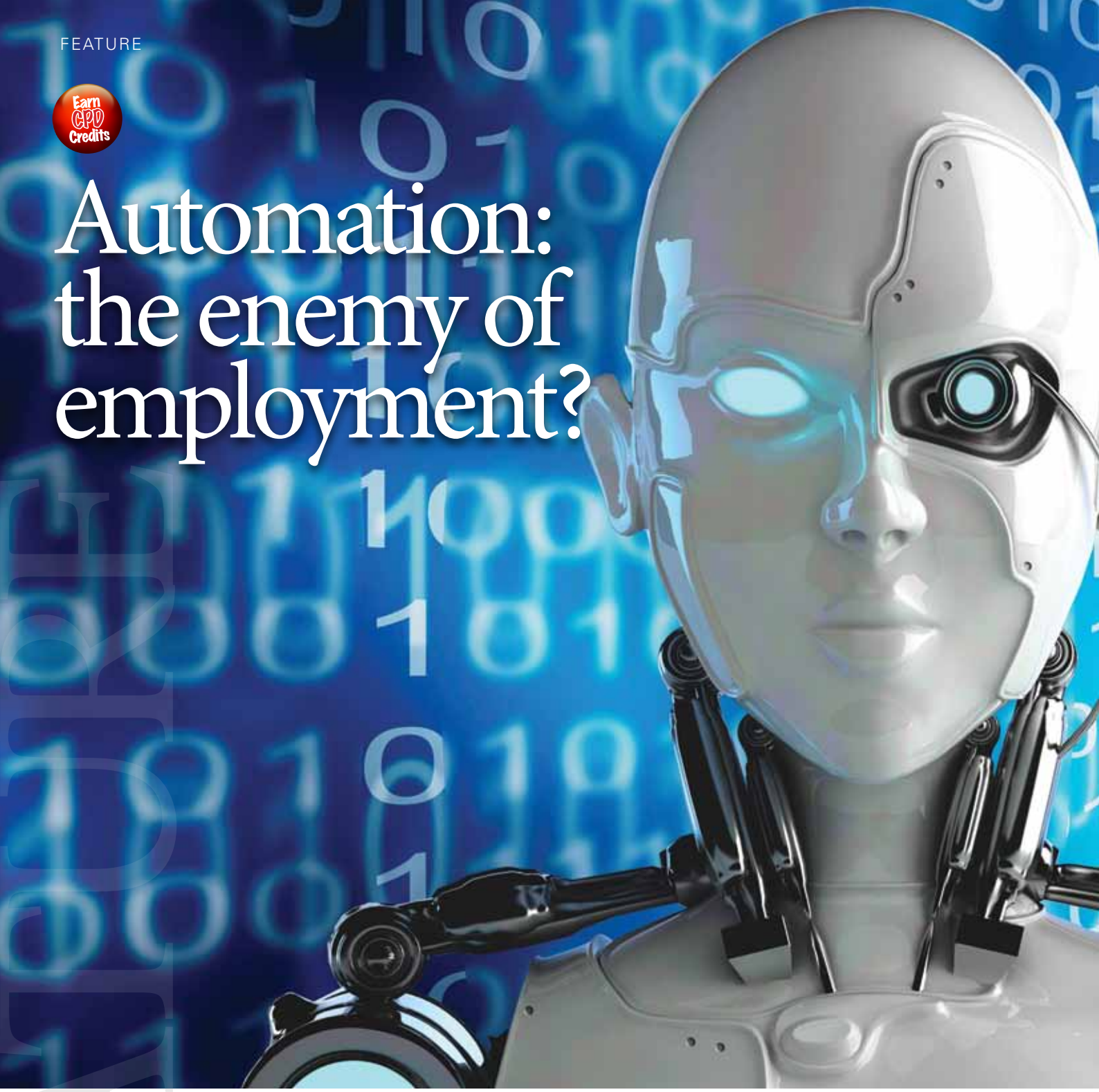
Automation: the enemy of employment?



Most managers agree that automation is an important part of their business's future, though there are worries around the effect on employment.

BY I BRENT BALINSKI

In May 2015, China's Shenzhen Everwin Precision Technology announced it would be deploying robots en masse at its Dongguan factory, with the goal of reducing its workforce from 1,800 to 200.

It was an example of the Pearl River Delta region's (and China's) massive effort to increase productivity, adapt to rising wages, and to reinvent manufacturing through automation. The Chinese electronics company would also, with its "all-robot factory", be doing away with 90 % of its workers.

A worldwide rush to automate through robots and other means is well and truly underway. The International Federation of Robotics' industrial robot sales figures for 2014 won't be out until late September 2015, but its preliminary report showed annual sales jumping 27 % last year. China was by far the biggest purchaser with a 54 % increase over the year to about 56,000 units.

The expanding use of computerised help is a hot topic for research, reporting, and speculation worldwide regarding what the future will mean for jobs and lives.

The current edition of Foreign Affairs is themed "Hi Robot: Work and Life in the Age of Automation", for example. Last year's best-seller list included *The Second Machine Age and The Glass Cage*. News stories on the subject, citing the Oxford University's Frey and Osborne's influential 2013 paper – *The Future of Employment*, finding 47 % of US jobs could be replaced by computerisation within
20 years – have become fairly regular.

Last month, a Committee for Economic Development of Australia paper, "Australia's Future Workforce?", used Frey and Osborne's research to model that 5 million Australian jobs had a high probability of being automated within 10 – 15 years.

"Stories come from people who see manufacturing around the world who say that we're not as advanced as our first-world competitors," explained Mark Goodsell, the Australian Industry Group's NSW director. "Or, indeed, some of the emerging nations, like China, who, given their relatively recent expansion in their manufacturing capacity have begun to, in a lot of cases, adopt the latest technology."

The willingness to invest seems to be acknowledged, however, and there are signs that, like everywhere else, interest in is picking up. Examples of this include the establishment of a third local partnership by collaborative robots company Universal Robots last month, after launching only last year.

A Hall & Partners Open Mind survey of 100 manufacturing executives last year for *The Australian* found 67 % believed "automation [was] the future of manufacturing".

According to recent survey results by corporate advisory firm Grant Thornton, 49 % of Australian businesses (including sectors other than manufacturing) were planning to invest in automation over the next 12 months. This wasn't very far behind a global average of 56 %.

WILL ALL OUR JOBS DISAPPEAR?

For all its many benefits – such as improving speed, productivity and safety – there is still anxiety around automation, due mainly to employment concerns.

A general decrease in manufacturing employment numbers – even in countries that have seen growth in their industrial sectors, such as China, Germany and the US – is often put down to increased automation.

Within Australia, manufacturing's share of employment peaked in the 1960s. For the absolute number working in the sector,

Automation: the enemy of employment?

continues from page 31

this peaked in the 1970s. Manufacturing employs around 910,000 currently.

Research by University of Melbourne's Professor Jeff Borland, published last year in March, shows about 400,000 jobs had disappeared from the sector since the 1970s.

There are three things to be considered regarding the decline in employment, explained Professor Borland, who also noted that the gross number of jobs and the share of employment should be considered separately.

Firstly, an increasing amount of money was being spent locally on service-type goods. Secondly was an exposure to international competition – for example in labour-intensive goods – after the trade barriers came down.

Lastly was technological change, with the replacement of routine tasks particularly felt in manufacturing employment due to a disproportionate share of routine-type jobs.

"It's not the only industry, because you've got other industries with more clerical-type jobs that predominate: they've been affected as well," Professor Borland told Manufacturers' Monthly.

"But when you have routine tasks, as in manufacturing, then technological change has an impact."

An improvement in productivity will generally see fewer workers being needed to create the same amount of products.

"So while there's not sort of a simple relationship – 'the only thing that automation does is destroy jobs' – on balance, in manufacturing, the effect of job destruction has probably been greater than the effect of job creation," Borland added.

It is the rate of change, due to technological progress, that has some concerned about potential job destruction in manufacturing and elsewhere.

"Quite simply, we are entering a new Industrial Age," CEDA's CEO, Professor Stephen Martin, told Manufacturers' Monthly the week his organisation's report was released.

"That Industrial Age is going to see the use of computerisation and mechanisation go to levels that we've not previously contemplated."

Higher levels of technology aren't a disaster, of course, and Professor Borland pointed out that automation could also create jobs.

"The first inclination should be of 'what other opportunities does this give us?" explained Herbert Hermens, CEO of Keech Australia, a third-generation castings and engineering business based in Bendigo.

Efficiency and reliability have been increased and manufacturing costs down through investments in automation at Keech, said Hermens. Market opportunities have increased.

"It doesn't always have to be linked immediately to losing employment opportunities, because it actually offers more opportunity if you look at it positively," he said.

OPPORTUNITIES AND CHALLENGES

The year 2012 was a generally difficult one for Australian manufacturing.

There was regular speculation (eventually confirmed) that the remaining three car manufacturers would end their local assembly operations, a high dollar was sending many firms to the wall, and the then-prime minister commissioned a taskforce of experts to help find a way forward for the industry.

At the time, director Ryan McClenaghan, co-founder of Micron Manufacturing, saw an opportunity to start a business.

Enabled by state-of-the-art metalworking technology, a focus on a tightly defined niche, and a business model adopted from Japanese examples, Micron – which employs only seven – has seen success since. Last year it made the Business Review Weekly's (BRW) Fast Starters list and this year qualified as a finalist in this magazine's Endeavour Awards (Most Innovative Manufacturer category).

A high degree of automation is a major ingredient in its success as a sheet metal fabricator, allowing things such as a high level of monitoring and computerised feedback and a lights-out operation on weekends.

"I could close the door here, for example, on Friday night and we set up four tonnes of material and we come back Monday morning and it's done," McClenaghan told Manufacturers' Monthly.

The operation is highly flexible, with a dozen different jobs completed at

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As at 05/08/2015

Automation: the enemy of employment?

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Micron's Glendenning operation on the Tuesday before our 2 pm phone call. "A lot of our jobs are high-mix, low-volume," McClenaghan said. Micron services sectors including electrical, resources, oil and gas. They perform R&D work for an Australian maker of fridges, though eventually the final product is made in China.

"We do a lot of prototyping. Then we might roll out the first 100 before overseas get it right, maybe 1,000, maybe 2,000," added McClenaghan.

The efficiency of machines is monitored in real-time through sophisticated analysis software.

He gave the example of a laser cutter left unattended over the weekend, which ran at 97.2 % efficiency for 32 hours.

"The only downtime it had was changing the machine over," he said.

"So we look at that, it's an automated laser machine, and you compare that to a manual load and unload – your efficiencies would probably be 30 %."

Keech has a different story, but one that featured the benefits of modern techniques and equipment to remove labour and increase effectiveness.

An 81-year-old business, it has grown sharply in recent years, aided by investments in technology such as industrial 3D printing and automating processes including engineering and mould-making, and grinding and breaking off casts. "Six years ago there were very few computers on the floor – now there's computers everywhere!" said Hermens.

"There's computers in people's pockets, there are stations, and now of course a lot of our equipment is computer-driven. And so we've had to interact and enable people to interact."

Not adapting meant cheating yourself, according to Keech, giving up productivity improvements and the chance to be more competitive in a market.

Stuart Shaw, Red Meat Business Manager at Machinery Automation & Robotics, pointed out that this wasn't the same as laying off workers.

"From this perspective, automation helps to save and create jobs by ensuring our clients are competitive," he said.

What sort of skills will be in demand?

It's generally agreed that technology is changing the types of things people do at work.

Goodsell said this would continue, and would gather pace within manufacturing. Fewer people are needed to operate machines on the shop floor, but more skills are needed in areas such as designing, integrating, dissembling and reassembling equipment.

"So the traditional tradesman who was operating the machine and producing the product in conjunction with the machine is being replaced by somebody who can think about what machine is needed, can program it, monitor it, tweak it, and integrate it into the rest of the production line," he said.

"It's still important to understand the basics and the mechanics of what's going on and that's why, still, a lot of companies like people who've got hands-on experience as well as a high level of technical knowledge. That combination's very useful."

Still, the number of people employed in local manufacturing is predicted to continue to decline overall.

Phil Ruthven, founder of IBISWorld and a contributor to the CEDA report, predicted that over half the jobs lost in the next five years would be in manufacturing.

Professor Martin agreed that jobs in "traditional" manufacturing would continue to decrease in coming years, citing the exit of the car makers in 2016/2017 and the flow-on effects among suppliers. Also, continuing improvements in technology would mean fewer people would be needed for the same output.

"There will always be a manufacturing base, as the methodology, the skill sets all change, as mechanisation is applied, as there's greater use of computer, then clearly it's going to mean that the number of people with fewer skills will be needed in those operations," he explained.

Although increased automation can create jobs, it is difficult to find somebody predicting that it will lead to growth in low-skilled, routinisable roles in factories.

Another recent survey by Grant Thornton bears this out, surveying 2,571 executives in 36 countries and finding that 43 % of manufacturing businesses were looking to automate away 5 % or more of their workforce.

The survey also suggested technology

would change many roles, with 44 % of manufacturers intending to "redeploy rather than remove staff."

WHAT SKILLS WILL BE NEEDED

What machine learning, the industrial internet and other advances will see created in the way of new manufacturing jobs is an open question.

Industry 4.0 app developers, collaborative robot trainers and more data analytics roles represent three pieces of speculation.

What's likely is that the factory of 20 years from now will look very different to one in 2015, and so will the workforce making it run.

So what abilities will be in demand by the manufacturers of the future? As the Business Council of Australia, CEDA, the country's Chief Scientist and others have said, STEM skills will be vitally important in a highly data-driven world.

Goodsell believes that certain STEM-based capabilities, systems thinking, leadership and design led innovation skills will be highly sought after. Trends of increased flexibility, greater responsiveness, and shorter production runs within factories will mean a knack for uncovering customers' needs would gain in importance.

"You don't really make something now until you've got a pretty good idea that somebody wants that thing in the form that you can make it," said Goodsell.

"This type of design thinking is a higher level skill than most companies give credit to. It's a higher-level skill than most companies have traditionally had.

I've noticed one trend in the last two or three years talking to manufacturers, almost all of them have been working on this capability in their company."

Those daunted by the future – and one with probably fewer factory floor jobs in it – can at least take heart in the knowledge that the workforces of most industries are tipped to be radically reshaped in coming years by computerisation.

An obvious example, driving a car, was long considered an impossible task for a computer to master.

Self-driving vehicles will likely be mass-produced by the end of the decade, with huge disruptions in the logistics industry a probable result.

You could also consider that every technological revolution has seen living standards improve and jobs created in the long run. (Though some have their doubts that this time around will be pleasant for all, and have suggested a "hollowing out" within economies, with many middle-class jobs disappearing.)

Years ago, roads were laid with picks and shovels. There are fewer people doing the job, which is now mechanised, much easier, and has an end result of a higher quality.

At the same time, life has, on the whole, gotten better. "Those workers have found other opportunities," he said. "The Australian nation has grown, opportunities have grown. Automation does not necessarily, as a whole for the nation, mean that fewer people will be employed." wn

Earn CPD Credits

BY | JIM PINTO

After fourteen years of the new millennium, here are my views on the directions in which the automation industry is moving.

THE REAR-VIEW MIRROR

Because of the relatively small production volumes and huge varieties of applications, industrial automation typically utilizes new technologies developed in other markets. Automation companies tend to customize products for specific applications and requirements. So the innovation comes from targeted applications, rather than any hot, new technology.

Over the past few decades, some innovations have indeed given industrial automation new surges of growth: The programmable logic controller (PLC) – developed by Dick Morley and others – was designed to replace relay-logic; it generated growth in applications where custom logic was difficult to implement and change. The PLC was a lot more reliable than relay-contacts, and much easier to program and reprogram. Growth was rapid in automobile test-installations, which had to be re-programmed often for new car models. The PLC has had a long and productive life – some three decades – and (understandably) has now become a commodity.

At about the same time that the PLC was developed, another surge of innovation came through the use of computers for control systems. Mini-computers replaced large central mainframes in central control rooms, and gave rise to "distributed" control systems (DCS), pioneered by Honeywell with its TDC 2000. But, these were not really "distributed" because they were still relatively large clumps of computer hardware and cabinets filled with I/O connections.

The arrival of the PC brought low-cost PC-based hardware and software, which provided DCS functionality with significantly reduced cost and complexity. There was no fundamental technology innovation here—rather, these were innovative extensions of technology developed for other mass markets, modified and adapted for industrial automation requirements. On the sensor side were indeed some significant innovations and developments which generated good growth for specific companies. With better specifications and good marketing, Rosemount's differential pressure flow-sensor quickly displaced lesser products. And there were a host of other smaller technology developments that caused pockets of growth for some companies. But few grew beyond a few hundred million dollars in annual revenue.

The Future of Industrial Automation

Since the turn of the century, the global recession has affected most businesses, including industrial automation.

Automation software has had its day, and can't go much further. No "inflection point" here. In the future, software will embed within products and systems, with no major independent innovation on the horizon.

The plethora of manufacturing software solutions and services will yield significant results, but all as part of other systems.

So, in general, innovation and technology can and will reestablish growth in industrial automation. But, there won't be any technology innovations that will generate the next Cisco or Apple or Microsoft.

We cannot figure out future trends merely by extending past trends; it's like trying to drive by looking only at a rear-view mirror.

The automation industry does NOT extrapolate to smaller and cheaper PLCs, DCSs, and supervisory control and data acquisition systems; those functions will simply be embedded in hardware and software. Instead, future growth will come from totally new directions.

NEW TECHNOLOGY DIRECTIONS

Industrial automation can and will generate explosive growth with technology related to new inflection points: nanotechnology and nanoscale assembly systems; MEMS and nanotech sensors (tiny, low-power, low-cost sensors) which can measure everything and anything; and the pervasive Internet, machine to machine (M2M) networking.

Real-time systems will give way to complex adaptive systems and multi-processing.

The future of Industrial Automation

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The future belongs to nanotech, wireless everything, and complex adaptive systems.

Major new software applications will be in wireless sensors and distributed peer-to-peer networks – tiny operating systems in wireless sensor nodes, and the software that allows nodes to communicate with each other as a larger complex adaptive system. That is the wave of the future.

THE FULLY-AUTOMATED FACTORY

Automated factories and processes are too expensive to be rebuilt for every modification and design change – so they have to be highly configurable and flexible. To successfully re-configure an entire production line or process requires direct access to most of its control elements – switches, valves, motors and drives – down to a fine level of detail.

The vision of fully automated factories has already existed for some time now: customers order online, with electronic transactions that negotiate batch size, price, size and colour; intelligent robots and sophisticated machines smoothly and rapidly fabricate a variety of customized products on demand.

The promise of remote-controlled automation is finally making headway in manufacturing settings and maintenance applications. The decades-old machine-based vision of automation – powerful super-robots without people to tend them – underestimated the importance of communications. Today, this is purely a matter of networked intelligence which is now well developed and widely available.

Communications support of a very high order is now available for automated processes: lots of sensors, very fast networks, quality diagnostic software and flexible interfaces – all with high levels of reliability and pervasive access to hierarchical diagnosis and error-correction advisories through centralized operations.

The large, centralized production plant is a thing of the past. The factory of the future will be small, portable (to where the resources are, and where the customers are). For example, there is really no need to transport raw materials long distances to a plant, for processing, and then transport the resulting product long distances to the consumer. This was done because of the localized know-how and investments in equipment, technology and personnel. Today, those things are available globally.

HARD TRUTHS ABOUT GLOBALIZATION

The assumption has always been that industrialized nations will keep leading in knowledge-intensive industries while developing nations focus on lower skills and lower labour costs. That's now changed. The impact of the wholesale entry of 2.5 billion people (China and India) into the global economy will bring big new challenges and amazing opportunities.

Beyond just labour, many businesses (including major automation companies) are also outsourcing knowledge work such as design and engineering services. This trend has already become significant, causing joblessness not only for manufacturing labour, but also for traditionally high-paying engineering positions.

Innovation is the true source of value, and that is in danger of being dissipated – sacrificed to a short-term search for profit, the capitalistic quarterly profits syndrome. Countries like Japan and Germany will tend to benefit from their longer-term business perspectives. But, significant competition is coming from many rapidly developing countries with expanding technology prowess. So, marketing speed and business agility will be offsetting advantages.

THE WINNING DIFFERENCES

In a global market, there are three keys that constitute the winning edge:

- Proprietary products: developed quickly and inexpensively, with a continuous stream of upgrade and adaptation to maintain leadership.
- High-value-added products: proprietary products and knowledge offered through effective global service providers, tailored to specific customer needs.
- Global yet local services: the special needs and custom requirements of remote customers must be handled locally, giving them the feeling of partnership and proximity.

To implementing these directions demands management and leadership abilities that are different from old, financially-driven models. In the global economy, automation companies have little choice – they must find more ways and means to expand globally. To do this they need to minimize domination of central corporate cultures, and maximize responsiveness to local customer needs. Multi-cultural countries, will have significant advantages in these important business aspects.

In the new and different business environment of the 21st century, the companies that can adapt, innovate and utilize global resources will generate significant growth and success. wn

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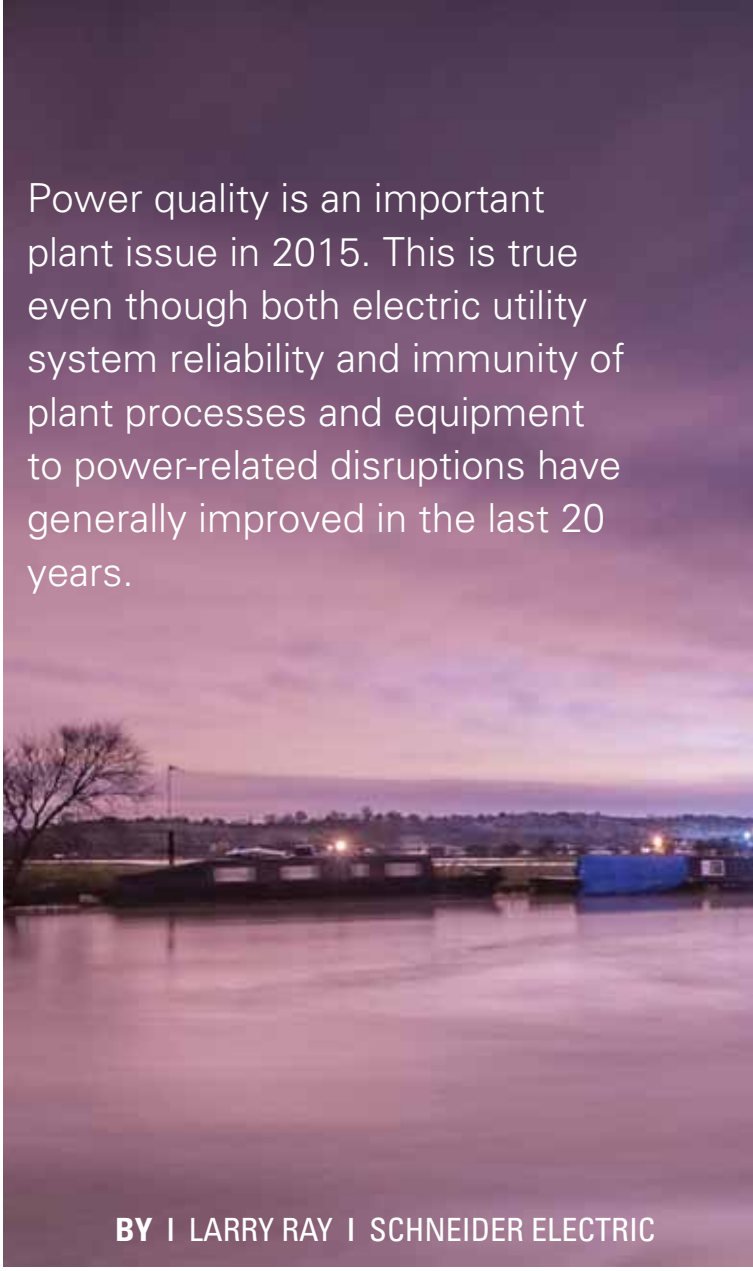
Preserving power quality in changing times



Power quality is an important plant issue in 2015. This is true even though both electric utility system reliability and immunity of plant processes and equipment to power-related disruptions have generally improved in the last 20 years.

BY | LARRY RAY | SCHNEIDER ELECTRIC

It will remain important in the coming years as a proliferation of distributed energy resources like solar and wind continues to comprise a larger portion of the energy generation mix. So how can you ensure that your facility is unaffected by these changes? Here are a few tips to consider as you revisit your power quality priorities.

PAY ATTENTION TO THE BASICS

Facility managers need to recognize that most power disturbances result from degradation of or damage to the power wiring systems, especially to the bonding and grounding systems in an industrial facility. Regardless of the energy-supply mix, effective grounding systems will continue to be vital to the safe and reliable operation of the power distribution system.

Normally, managers don't think of an effective ground-fault return path as even necessary, much less half of the power circuit, but that is the case during any phase-to-ground fault. An effective bonding and grounding system ensures that employees are safe, equipment damage is limited, and the trouble is confined to the smallest possible part of the electrical system.

Deterioration within the power wiring system is more widely accepted as a power quality concern that justifies a portion of the maintenance budget.

Power conductors carry current 24/7 to enable electrical loads to operate correctly, so loose connections in these systems receive careful attention-in the manner of infrared scanning to identify loose (hot) connections, and active power monitoring and control systems.

Grounding systems, however, transmit high currents only during fault conditions or surge events, so degradation is harder to track and easier to neglect. Like an airbag or parachute, however, it would be really nice to know that the grounding system will work as intended when required. Fortunately, there are ways to determine the state of a grounding system that don't involve the equivalent of crashing into a tree or jumping from an airplane.

DETERMINE IF YOUR SYSTEM NEEDS ATTENTION

There is a fourfold approach to grounding system assessments that are recommended:

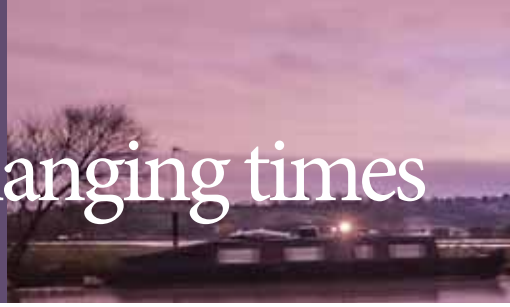
- Review the grounding system design; IEEE Standards 3003.1 (System Grounding) and 3003.2 (Equipment Grounding) are useful here.
- Inspect to determine the condition and adherence to the design, especially at key points like substations, transformers, generators, and transfer switches.
- Test any portions of the grounding system that are suspect or cannot be inspected; see IEEE Standard 81-2012, for example.
- Correct any deficiencies or areas of concern or uncertainty.

The grounding-system design review starts with power equipment and generators. Are these systems intended to be solidly grounded? Resistance or impedance grounded? Or ungrounded? Each system type has different requirements with regard to the magnitude and handling of ground-fault current, protective relaying, ground-fault detection, transient-voltage surge suppression, and, of course, the types of loads that can be operated effectively from each system type.

Whatever the power system type, at least three aspects of grounding should be consistent:

- All grounding electrodes, ground buses, conduit, cable trays, metallic structures, and electrical equipment at the facility shall be bonded together to minimize voltage potential differences between any of that equipment. (Actually, "shall" is the correct word-it is a requirement of the National Electrical Code) This includes other utilities like water piping, gas lines, and fueling equipment.
- This bonded network should be connected to earth in a manner that ensures a low impedance path at all points in the system.
- A lightning abatement system should be considered based on the lightning frequency and density data for the region. See NFPA 780, Standard for the Installation of Lightning Protection Systems.

Preserving power quality in changing times



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FINAL POINTS ABOUT GROUNDING

Not sure if that metallic conduit constitutes an effective ground-fault return path? A qualified expert with a direct or two-point resistance method can test the integrity. Will the grounding assessment and testing require a shutdown? Unfortunately, yes. Most likely some portion of the system will need to be de-energized so internal inspections and testing of power-system components can be performed safely and effectively.

What are the common corrective actions required? Mitigation for grounding deficiencies generally involves additional grounding conductors, replacement of grounding straps or connectors, additional connections to the grounding/bonding system, and additional or replacement grounding electrodes (ground rods-but never "isolated" and always bonded to the rest of the grounding system).

Often, the overcurrent protective devices like circuit breakers may require ground-fault settings to be changed.

These improvements can be low-cost insurance against the disruptions caused by grounding anomalies.

THE "OTHER HALF" OF POWER DISTRIBUTION

Earlier, I mentioned loose connections, or points in the power wiring where inadequate connection points have been introduced or exist due to deterioration. These are so common as to support an entire industry of on-site testing using sophisticated cameras that can detect the infrared energy emitted by faulty connections. Newer technologies exist as well, like remote temperature sensors that can be affixed to connection points in the electrical distribution system and wirelessly transmit temperature data.

In addition, a properly placed and programmed power monitoring system can detect the erratic voltage and current signatures that result from insufficient connections. While the discontinuities in the current waveform may be harder to distinguish from load current among industrial equipment, voltage sags and transients on the load side of faulty connections can be easier to detect.

In fact, one troublesome power quality problem at an automotive plant was finally resolved when we captured voltage sags on a feeder breaker when none appeared on the main breaker in the same switchgear lineup. The only possible explanation was a loose connection between the main and feeder. Sure enough, a shutdown and inspection revealed busbar lugs that were improperly terminated inside the switchgear, yet these were hidden from view of infrared scanning equipment.

ELECTRIC UTILITY RELIABILITY

Maintaining reliability is a concern that keeps utilities up at night and cause sleeplessness among plant engineers. Distributed energy resources, declining infrastructure, and changing weather patterns contribute to this concern. For example, installed solar power now exceeds 20 GW in the U.S., according to the Solar Energy Industries Association, and most of the growth is utility-scale projects.

Two of the key disturbance types to record and track at the service entrance include voltage sags and momentary interruptions. Voltage sags remain the most common power quality disturbance on a typical electric utility distribution system. A voltage sag is a brief (often lasting less than a second) and sudden decrease in effective voltage, frequently due to single-line-to-ground (SLG) faults on a nearby overhead distribution system. Voltage sags are brief because electric utility systems are designed to open the affected portion of a circuit and re-energize that section automatically, since most of the SLG faults can be extinguished by this operation.

If the portion of the radial overhead circuit on which the SLG fault occurs happens to serve your facility directly, then your disturbance may be a momentary interruption instead of a sag. This type of disturbance is generally more costly to mitigate inside the facility since the supply voltage drops to zero during the event. With most sags, however, voltage seldom dips as low as zero on all three phases.

In either case, the facility's power monitoring program should record these high-speed events, and report them regularly to their electric utility. While many events may occur during storms and are an unavoidable product of an overhead distribution system design, the utility may be able to make changes that reduce the frequency and magnitude of these events.

The facility should log the time, date, and environmental conditions for each event, in addition to charting the magnitude and duration of the sag or interruption. A "mag/dur chart" can be a valuable tool in resolving troublesome disturbances that can adversely affect plant operation. wn

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AN INSIDER'S ACCOUNT

Black Friday 1975 - what really happened

BY | BEV LAWRENCE | FSAIEE

I really enjoyed Antonio Ruffini's article in the June edition "Blackouts and their prevention in South Africa". Thanks Antonio for the many years of great writing with which you have entertained me!

As stated, the only Blackout in Eskom's history occurred on "Black" Friday 4th December 1975. I suppose I am one of the few old "Eskom-ous" remaining, who lived through it and experienced the entire catastrophe and its disaster recovery.

have now read three accounts of this event, all of which differ somewhat in their telling. The one was written by Jacques Messerschmidt and Steve Conradie in the wonderful book "A Symphony of Power" – the history of Eskom. This book chronicles the entire development of the Generation, Transmission and Distribution sections of Eskom since its formation in 1922, placed alongside the financial, social and political occurrences as they played out. On page 225 is written:

"A malfunctioning relay at the Hydra substation near De Aar….cutting the entire Cape Province off from the rest of the country. Cape Town was plunged into chaos….In the Eastern Cape …major interruptions….Large parts of the country were plunged into darkness….more than 24 hours before a semblance of normality was restored. The second is a paper dated 1978 by Frans Conradie and Tony Patterson of System Operation Division read at the SA Institute of Electrical Engineers, and is probably the most accurate. They state that a CT fault at Vulcan substation initiated the event, causing under-voltage and under-frequency conditions in the vicinity, tripping the Wilge, Komati, Hendrina and Arnot stations (3577MW = 45% of the system load thereby reducing system frequency to 47.5Hz). And further that all supplies were restored by 23h54 on Friday night.

The other is the **watt**now article (June 2015), which I guess is derived mainly from Robbie van Heerden, Eskom's smart and capable GM Systems Operation. As System Operation is directly responsible for the stability of the entire grid, they are also responsible for its restoration should a total blackout occur. After the 1975 blackout they carried out an extremely far-reaching investigation into its cause and the restoration. Many corrective actions were implemented, which apparently were very successful, as there has been no re-occurrence since then (40 years!).

The steps taken by Eskom to avoid major grid instability thus appear to be extremely effective, and I agree that such an event seems most unlikely. However my version of the blackout, as well as the current restoration process and time differ somewhat from your article. So may I present my version of the events of that fateful day, and how we overcame it?

At the time I was employed at Arnot power station as Superintendent (Resources Procurement & Control), the development post for future Power Station Managers. In this capacity I was also Deputy PSM (Power Station Manager), acting on his behalf in his

Black Friday 1975

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absence. Arnot was at that time the newest and largest Eskom station, and was its showpiece to all the many visitors to the utility.

On Friday 4th December 1975, Mr. Ken Stevens (who recently passed away), the Maintenance Manager, was about to go on annual leave. To celebrate he invited us for snacks and drinks, and also to see his new colour TV, the first at Arnot (TV was being rolled out to go live on 1 Jan 1976). The TV was on, showing the colourful test pattern, and at 6pm the programming started with news, read by Dorianne Berry. We were all duly impressed with the amazing transmission colour and clarity.

After about half an hour the picture disappeared, only to reappear after a few seconds. This happened several times, and we thought the SABC were having teething problems. Then we noticed that the lights, which were on in broad daylight, were also dimming and brightening. Suddenly there was a most fearful roar of the sound of high-pressure steam, much louder than we were used to (sometimes units tripped, opening the boiler safety valves. As we resided on the Eskom property adjacent to the power station we were used to that). The lights and TV went off and stayed off, and we guessed something serious had happened at the station. I suspected a full station trip of all six units!

We all jumped in cars and drove rapidly to the station. When we entered the turbine hall it was like being on the sinking Titanic! All units were off, and only the emergency lights were on. The only sound was the "ticking" of hot steel contracting! We went to the Electrical Control room, and found that all units had tripped on under-frequency protection. The operators were trying to phone National Control to report the situation, but were unable to get them to answer.

There was nothing we could do, as we required a strong electrical supply to restart the large boiler fans. After about an hour of no response from National Control we started phoning other power stations and discovered that they were all in the same situation. It appeared every running unit throughout South Africa had tripped, leaving the country in a totally blacked out situation.

We never did get through to Control, but around midnight the lights began to come on again, and we found that our High Voltage yard had been "mysteriously" re-energised from somewhere. We wasted no time, and started up the water plant to get demineralised water to our units. We then proceeded to light up the boilers one by one, and get the turbo-generators running, synchronised and loaded to supply energy to the grid.

This had to be done one or two at a time and took many hours. I can't recall how long, but we stayed at the plant coordinating restoration efforts for most of the next 24 hours.

Meanwhile, the people of South Africa battled to deal with the awful situation. Factories and mines normally running over the weekend were unable to operate, with miners stuck underground. Offices and businesses were shut down, and were unable to trade, especially the larger shops with underground departments, which were in total darkness. People were trapped in lifts throughout the country, and had to be freed. Hospitals emergency lights went off when their generators ran out of fuel. It was terrible!!!

Gradually however, power stations bagn to get their units going again, and power supplies were restored throughout the country. My recall is that by Monday all was normal again. So, it seems that full grid restoration was accomplished in about two to three days, in a situation where the Utility was not well prepared for such an eventuality, and how to recover from it.

My recollection of the report is that a subsequent investigation revealed that a new substation, Vulcan, was being built near Witbank. A new CT failed shortly after energising. The protection circuits installed to detect this and open the breakers, on either side of it, failed to operate. Apparently they had not yet been correctly set?! The resulting huge fault current caused a severe voltage depression to the surrounding parts of the grid.

The voltage at the nearby Wilge Power station was depressed sufficiently to cause all the generating units to trip on Under-voltage protection, dropping the grid frequency as well. The low voltage and frequency spread to the next station, Komati, and that station also tripped. This cascaded across most of the interconnected system (of 8000MW), plunging almost the entire country into darkness.

I'm not sure if System Control had recovery plans for this. None of the newer PF-fired (Pulverised Fuel-fired) stations were able to restart on their own. And the Hendrik Verwoerd (now Gariep) Dam Hydro-Station could start up but was too far away to send useable voltage supply. Fortunately,

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BBBEE
LEVEL 4

Black Friday 1975

continues from page 46

the old chain-grate power stations around the coast had fires still burning, and steam stored in their steam receivers between the boilers and turbines (which were not unitised). They were thus able to get their generators running again, and send power to the old Colenso and Ingagane stations in Natal, who could then send to Camden and eventually all the Eastern Transvaal stations.

Today the situation is totally different. Many improvements have been added to the system to avoid, as far as possible, the frequency- or voltage- deteriorating to unstable levels. The recovery procedure is well documented and tested. In 1999 the threat of the "Millennium Bug" arose, and National Control decided to test the Grid Recovery Procedure.

At the time I was Electrical Engineering Manager at a large coal-fired power station, and their Mr. Mike Haddingham liaised with me to devise and perform such a test.

We developed a suitable test procedure and had it approved by the various office-bearers responsible for such a risky matter.

On a particular Sunday the test was started. All the necessary instructions were made known to everybody involved, and responsibility and multiple communication channels established. The Auxiliary 400kV busbar in the station's High Voltage yard was linked to supply one of the station's 11kV Unit boards, which supply power to the station's auxiliary (common) plant – coal, ash, water, etc. Also one boiler/turbo-generator was connected to this busbar, as well as one HV power line, which were connected at the other end to supply the town of Centurion.

When all was fully prepared, the generating unit was tripped by hand, and Centurion power supply ceased. We all watched anxiously to see whether the recovery system would operate correctly.

Immediately the zero-voltage sensor on the station boards sent a signal to start up the gas turbine installed at the station's HV yard for this purpose. Within a couple of minutes the Station board was re-energised by the gas turbine. A loop supply was then switched in to supply 11kV to the (tripped) Unit's unit boards.

This enabled the Unit operators to restart their boiler and then, when sufficient steam pressure and temperature were available, to run up the turbo-generator. This allowed the generator to start sending power to the blacked-out town, and full supply was restored (note that it didn't have to first be synchronised before it could send power – why not?!). The whole operation took about an hour!

This now forms the main thrust of National Control's recovery plan. In the case of a real total system blackout, power from the first unit to recover would be sent to other units at the station, as well as to other stations in the vicinity to enable them to also start.

Simultaneously I think that Eskom's Plans B and C would also swing into action.

A pumped storage scheme unit would be started from diesel generators. This would then send power to the nearest coal-fired stations stations, allowing them to run up their units, and continue in the process of grid restoration. My guess is that the entire grid could be restored in two days if all went well!!!!

As the article stated the grid is highly protected by a number of interventions to try to ensure a full blackout does not occur. The Grid Code requires that the entire scheme is live-tested periodically to ensure that it is still fully operational!

A further refinement is that in the event of an HV yard fault, many of the larger coal-fired generating Units are able to "Island" themselves, and continue generation, supplying power to keep themselves operating at 'house" load until the fault has been cleared and the grid stabilized. They can then be re-synchronised and loaded in a relatively short time.

So I hope that a System Black-Out never happens, but if it did I feel confident that the Utility would be able to recover in a relatively short time, limiting the disruption to the country and its residents, businesses and the economy. wn

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The Lynx

Cable-theft has become a massive burden; never mind the effect of the "outage time" on the country's economy, but there are also great financial implications involved in replacing the stolen cable. The following event actually took place next to a mine-dump in the Germiston area, a number of years ago. It goes to show that cable-thieves knew that the owners would replace the stolen cable, and in doing so, that the owners had just GIVEN the thieves another length of cable!

The event: It was about 4am one wintry morning. A team of technicians and labourers were replacing nearly a kilometre of signalling cable that had been stolen the previous night; and they've been busy working on this for nearly 24 hours. Finally, the cable was in place in its trench, it was joined correctly, all the tests had been performed, and the power had been restored to the equipment. The trench was then closed as per regulations. Everyone concerned was exhausted and ready to go home for much needed rest. As the team was about the leave, a voice floated from inside the mine-dump: *"Thank-you bossy, you will not be 'long-gone', when we will take the cable again."*

The Lynx

continues from page 51

While 'bossy' managed to foil their plan to remove the cable again, by notifying the police, this did not stop (other) thieves from costing the country in the region of R5-billion per year.

BACKGROUND

Following 50 years of experience in Railway Signalling, where copper cables are extensively used (both in South Africa and the United Kingdom), Coenie Groenewald did his initial design of "The Cable-Anti-Theft Device". This device has since undergone a number of design and testing modifications, in order to improve its effectiveness.

THE LYNX

In its present state, the Lynx consists of 3 parts; the Anchor, the Cable Holding Plate and the Cable Securing U-Bolts.

The Anchor

These images show the development of the Anchor.

The development of the Anchor

Starting from the left:

1. The original design of the anchor. This was an unnecessarily elaborate design, and was soon replaced with the anchor in the 3rd photo.

2. When installing the anchor, suitable sized holes were made using spades, and/or a power-operated augur. The anchors were then cemented into the holes for the various tests that were performed.

3. The modified anchor (shown in picture 3) was used for the different tests, and to prove that the devices are effective. They were cemented into the trench at intervals, to secure it to the holding plates.

The Holding Plate

This show the development of the Holding Plate(s).

1. The picture is of the original design used in testing of the complete device. It did not fail completely during testing, but to improve the effectiveness, a number of changes were made, including making use of a thicker plate with a folded edge.

2. The newer design, was used in the next test. It not only proved to be not altogether successful, but in many ways better than the original design.

   These subsequent Holding Plate designs overcame the failings of the earlier designs, and have been patented. In the design pieces of flat bar are welded onto the underside of the plate, which grips onto the cable in 3-dimensions. The ends of the cable are then secured at each of the plate's 2 ends, by using suitable U-bolts.

The 'U-Bolt'

1. The U-Bolts used during the tests, are manufactured from 12 mm solid round bar and 12 mm threaded rod. The rods

U bolts

are then cut at 45 degrees and welded together, as shown on the corners.

2. The width of the U will depend on the size of the plate required, to accommodate the number of cables needed to be inserted and secured. The length it protrudes also depends on the size of the cables, and can also be cut off if they protrude too far past the securing nuts.

THE TYPICAL METHOD

The diagram in Figure 1 shows a typical way of fixing the cables to "The Anti-Cable-Device", aka The Lynx, in the normal way. It is recommended that these devices be fitted close to the equipment or apparatus cases; and then at no more than 10m apart, along the cable span to maximise the effectiveness of the system. This would limit the length of cable that could be stolen between 2 devices, and make it less profitable for the thief.

LATEST TEST

Several tests were performed when testing the Lynx. Where possible the entire procedure was visually recorded, photographed and documented, and can be viewed on request.

It is obvious that in presenting test-results to potential users, it is essential to perform tests in a comparable way, and under similar circumstances. There are many different standards of securing cables in use in the country, and now even varying within companies such as Transnet. We therefore opted to use a trench 800 mm deep x 400 mm wide, as this has been a standard for many companies over the last 50 years.

The tests were designed to determine whether the Lynx holds the cable securely, and that the entire cable cannot be lifted. Furthermore, the tests were designed to be repeatable, so that results can be verifiable.

The final test were performed on the 7th of August 2015 and proved that the patented and design-registered device performed even better than what had been anticipated. The standard methods of burying and securing the cable underground, as described earlier, were used.

Four devices were installed and used to secure the cable(s), as described below:
Approximately 45m of 3-core 6mm^2, armoured copper power cable was used, the cable was doubled up to increase the tensile strength and in order to create a loop at the end. This loop was attached to a vehicle, in an attempt to pull the cable out of the ground.

The cable was laid as per the following guidelines:

1. The 2 strands of a single cable, each approximately 23 meters long, were used for this test. The 2 strands, were placed next to each other inside soft soil, at the bottom of the trench, for approximately 15 meters, to prevent damage to the cable.

2. The cable was then further secured further, by placing 500 mm x 300 mm x 50 mm thick re-enforced concrete slabs, along the length of the trench, on top of the soft soil. In this case there were only 2 of these slabs available, and improvised by using 300 mm wide pre-fab walling, instead.

3. The trench was back-filled with suitable soil, and it was compacted to a similar compaction to what it had been originally, as well as to that of the surrounding soil.

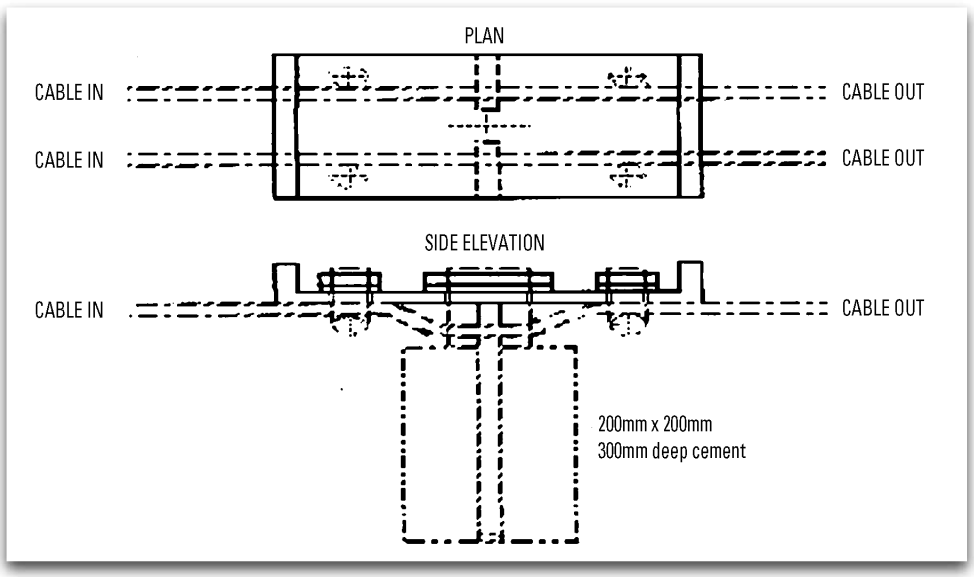

Figure 1

The Lynx

continues from page 53

PHOTOS TAKEN DURING AND AFTER THE TEST

These 6 photos show the following:

1. The trench with the anchors cemented into the bottom of the trench. This was done the previous Wednesday, to allow the cement to set for 2 days.

2. The cable was installed and secured with the 4 securing plates. The front of each of the devices, with the cable in the front, were sprayed with silver paint, to show any possible slip that occurred.

3. The trench was backfilled, covering only the front 2 devices, so as to be able to view any possible movement of the cable at the far end during the test.

4. The machine has taken up the slack, and is ready to perform the test.

5. A view of the first plate in the trench, after the trench had been opened up after the test had been completed. No movement to the plate, nor to the anchor was evident; even after the anchor had been dug out of the ground, together with the concrete. No damage to the foundation was found either.

6. This is a close-up of the front plate, closest to the side where the machine exerted the pressure to pull the cable out, but was only able to break the cable. No movement is visible on the paint on the cable, or the device.

These photos, together with many other photos, videos and the actual device, with the cable attached, are available on request for viewing.

THE BENEFITS OF USING THE LYNX

There is currently no effective method of preventing cable theft, or at least to minimize the effect of the theft, and thereby minimizing 'outage-time, or the present catastrophic effect on the economy would not exist.

While it is not possible to prevent all cable theft, this device does limit the length of cable being stolen. The benefits of this device are:

1. Given that only shorter cable lengths can be stolen at a time, it is unlikely that 'larger crime syndicates' will become involved. This is due to how labour intensive the task is for the small monetary gain, which can be achieved. This might deter organized crime from getting involved through using big trucks, if they can only steal short pieces of cable at a time;

2. Since only shorter lengths (± 5m) of cable can be stolen, outage time will be shorter (less time to open up cable trench, etc);

3. The cost of installing these devices, instead of the conventional methods of securing the cables, will differ very little, if at all;

4. Lastly, the device secures the cable so well, that a 90 kilowatt "front-end-loader" was able to break a 3 core 8mm^2 steel reinforced power cable in the first test; and a similar 3 core 6mm^2 power cable, in the second test; without the cable even moving in the device.

Besides demonstrating these tests at any venue to any prospective users, CAT D Technology will be very happy to also;

1. If the end-users require to have any further tests performed, CAT D will assist you in every way possible, with any technical assistance, as well as to provide the 'devices' for the test. CAT D would then reserve the right to use the results of these findings in our own further documentation.

2. CAT D would also attend the testing, to provide any on-site assistance.

These devices have been developed to assist everybody in the electrical and associated industries, in an attempt to try and curb the scourge that has become a massive problem. WN

For more information, contact
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WATT? is a forum related specifically to the industrial and commercial electrical sector.

Do you have any burning questions, topical issues or points of interest about the electrical industry, from the perspective of a contractor, supplier or professional service provider? Submit your comments, thoughts, ideas, suggestions or questions for the attention of our industry experts, and these will be addressed in a future issue of the magazine. This is your forum, and we would like to hear from you!

The rapid pace of technological change and product development is a global trend that affects entire economies. We may have access to more information than ever before, but is this information readily understandable? Does it give us insight into the fundamental issues? Is it precise and based on technical clarity?

WATT? is an opportunity for people on the ground to engage with each other and related professionals in an informative and friendly manner. This is a platform for you to discuss anything related to your particular sector, to highlight anything new, or to ask a specific question related to a technical topic or to engage in general industry issues. . Please note that we will not be considering anything related to the domestic sector, such as residential wiring.

We hope that this section of the magazine not only becomes a regular feature, but that it is widely read and distributed among your peers. Remember, it can only become a success with the full participation of our readers! Send your burning questions to minx@saiee.org.za - subject 'WATT?'.

We look forward to hearing from you.
- Ed

WATT?

EXPERT INDUSTRY ADVICE

QUESTION ONE

What are the built-in capabilities of a Variable Speed Drive (VSD)?

ANSWER ONE

Variable Speed Drives, or Variable Frequency Drives as they are also known in industry are not only used to control the speed of electric motors but also come with an array of standard features and functions to protect and control the electric motor installation while improving the overall effectiveness of plant and process control. Most Variable Speed Drives would come standard with a host of special features and functions such as motor thermal protection, internal VSD protection, self-diagnostics, PID control, PLC functionality and communication options.

QUESTION TWO

What special features and functions are available for the user?

ANSWER TWO

Variable Speed Drives come standard with a host of special functions and features. One of these functions, an on-board PID controller, makes it easier for the user to do process control without the need for additional external devices. PID control makes use of a feedback signal from a pressure sensor or flow sensor in conjunction with a user-defined set point in order to control the process. All the calculations and arithmetic is done within the VSD and can be fine-tuned by adjusting the Proportional, Integral and Derivative values within the VSD.

In addition to the above most VSDs come standard with a on board PLC functionality which allow the user to do basic PLC programming on the VSD and therefore again eliminating the use of additional external devices. The soft PLC as it is also referred to often come with pre-set application specific programs such as multi pump control, hoisting applications and many more.

These pre-defined application specific programs allows the user to make minimal changes to the existing setup therefore saving valuable commissioning time.

QUESTION THREE

What type of protection does the VSD offer in terms of motor overload protection and current limiting?

ANSWER THREE

The VSD almost certainly offers the most advanced type of protection that is available for electric motors. It can protect the motor against instantaneous overload, normal overload, under current and thermal overload conditions at various

points across the speed range from zero to full speed. The VSD calculates the thermal overload of the motor based on the current drawn at any specific point within the speed range as well as the duration (time) at that specific point.

On certain VSDs the motor current can be adjusted individually at five percent speed, fifty percent speed and at one hundred percent speed in order to have optimal thermal protection.

One of the biggest advantages other than being able to control the speed of the electric motor is the fact that the VSD offer a significantly lower starting current in comparison to direct on line and star/delta starters. Typically direct on line starters would draw in the region of five to eight times the full load current of the motor. On star/delta starters this value could be in the region of three to four times but when using VSDs this value would rarely exceed two times motor full load current. This does not only limit the electrical stress but also reduces mechanical stress considerably.

The advantage is that all of the above values, conditions as well as other process variables can be read back directly to the clients centralized information centre through the use of various communication options such as Profibus, DeviceNet, Ethernet, Modbus to only mention a few.

QUESTION FOUR

What about ease-of-use and training?

ANSWER FOUR

Most of the applications where variable speed drives are used in industry require very little programming to be done for basic applications and often only a handful of parameters would require change from the actual factory settings. For more advanced type of setups the selected supplier would normally have a dedicated service team who can assist with these more complex setup.

Most of the variable speed drives in the industry are relatively easy to use but care should be taken when selecting a product with regards to this as well as whether product specific training is provided by the selected supplier.

Most reputable suppliers in industry offer various different levels of training ranging from basic, intermediate to advance. wn

Answers provided by Zest WEG Group

IN MY OPINION : PROF ALEX FERREIN

RoboCup Logistics

Developing Benchmarks for Future Smart Factory Scenarios

For the first time since the inception of the monthly Opinion Piece, I've decided to co-write with a friend and colleague, who also happens to be a 'true' female engineer. Here's our opinion…

BY I PROF ALEX FERREIN I AACHEN UNIVERSITY I GERMANY

It is believed that the future of production lies in cyber-physical systems and the Internet of Things. In some regions of the world, this trend is also referred to as Industry 4.0. The vision is that with production transitioning from mass production to highly customized products in the near future, flexible production floors are required. The classical conveyor belt may, at least in parts, be exchanged by intelligent robots that will feed the right materials to the right machines at the right time.

The robot logistics problem is one of the upcoming challenges in this area. Today, there are already solutions for logistics robots in place. One example is the Kiva robot fleet (now amazonrobotics); another one is the warehouse robots Fetch and Freight. The purpose of this system is to support pick workers with their daily commissioning work. While in the former system, shelves are driven around autonomously to the pick worker, in the latter system a robot team drives through the warehouse to pick the required items directly from the shelves. In other scenarios, quad-copters for delivery tasks are foreseen.

Robot logistics applications are also in the focus of the RoboCup Logistics League (RCLL). While the RoboCup initiative was initiated to tackle the problem of building autonomous humanoid robots that can compete against the (then) human world champion by 2050, has broadened its scope also to very relevant fields such as rescue robots, domestic service robots, or logistics robots. In the RCLL, teams of up to three Festo Robotino robots have to plan, execute, and optimise the material flow in a smart factory scenario and deliver products according to dynamic orders. Therefore, the challenge consists of creating and adjusting a production plan and coordinate the group of robots. In 2015, the league introduced actual production machines. The RCLL competition takes

The RCLL competition takes place on a field of partially surrounded walls

place on a field of partially surrounded by walls. The game is controlled by the referee box (refbox), a software component which provides agency to the environment by instructing machines on the field. After the game is started, no manual interference is allowed, robots receive instructions only from the refbox and must act completely autonomous. The robots communicate among each other and with the refbox through WiFi. Communication delays and interruptions are common and must be handled gracefully by the robots.

The game is split into two major phases. In the first phase, the exploration phase, the robots have to map the factory floor to detect where the different machines are located. In the second phase, the production phase, the robots have to accept production orders and supply the different machines with the right materials according to some given production plan to fulfil the order.

Points are awarded for correct product deliveries. Pictured above shows the playing field with different types of machines allowing for complex production cycles. Different production machines such as Base Stations (BS), Ring Stations (RS) or Cap Stations (CS) stack different coloured rings onto each other to produce varieties of products. The different raw materials (coloured rings) have to be filled into the stations by the robots as well.

Besides challenging tasks in mobile robotics (autonomous and safe navigation, localisation, mapping, high-level control), the RCLL also caters for interesting and challenging planning and scheduling problems. Based on the dynamic orders that come in randomly, the team of robots has to agree on a production plan which maximises the expected outcome in terms of successful deliveries.

While the planning domain can be classified as medium complex, one has, however, to deal with a real-world domain with all its uncertainties, complex production plans with a variety of different products, and real-time orders. With the refbox, we have a central referee instance where all production data from the different machines come in. Furthermore, the refbox delivers the different orders to the robots. This means, that with this central entity, we can provide similar conditions for different runs of the game, and hence are able to provide conditions for Benchmarking the performance of the robots and the production strategy of the team. From the experience with our RoboCup team Carologistics, we can say that solving the tasks in this intriguing league requires for different skills from Mechanical and Electrical Engineering, Mechatronics, and AI and Computer Science.

It is an interesting research area for working on robot problems as well as in planning and scheduling, and it prepares the students, who actually program the robots and run the team, well for upcoming challenges in Industry 4.0 scenarios.

We released our 2014 robot software system as a whole. It can be downloaded from www.fawkesrobotics.org/projects/llsf2014-release/.

September

Movers, shakers and history-makers

COMPILED BY | JANE BUISSON-STREET
FSAIEE | PMIITPSA | FMIITSPA

1 SEPTEMBER

1858 The first transatlantic cable failed after less than one month of service.

2 SEPTEMBER

1837 Professor Daubeny, Professor Torrey, and Alfred Vail attended a demonstration of Samuel F. B. Morse's telegraph at New York University. Vail and Morse would become the first two telegraph operators on Morse's experimental line between Washington, DC, and Baltimore.

3 SEPTEMBER

1860 The Mercury arc lamp was demonstrated for the first time on the Hungerford suspension bridge in London, England by Professor J.T. Way.

4 SEPTEMBER

- AKA BRIGHT IDEA DAY

1888 George Eastman registered the Kodak trademark and received a patent for his camera which used roll film. This design was the first Kodak mass-produced camera, and it would largely be responsible for popularizing photography in the mass market. Adverts described it as a simple device: "Pull the String, Turn the Key, Press the Button."

5 SEPTEMBER

1857 Charles Darwin sent a letter to Harvard botanist, Asa Gray, that discussed his theory of evolution. The encouragement that Darwin received from Gray and others lead to him finally publishing his theory after twenty years of indecision.

6 SEPTEMBER

1989 About 41,000 Parisians received letters in the mail charging them with crimes such as extortion, murder, and prostitution. The mailings should have been traffic violation notices and were allegedly caused by a "computer error."

7 SEPTEMBER

1969 The first episode of Monty Python's Flying Circus was recorded.

8 SEPTEMBER

1994 Microsoft officially changed the name of the project code-named "Chicago" to "Windows 95."

9 SEPTEMBER

1908 Orville Wright made his first one-hour aeroplane flight in Fort Myer, Virginia.

10 SEPTEMBER

1984 Alec Jeffreys discovered Genetic fingerprinting accidentally while studying genetic markers across generations as a method of tracking patterns of inherited illness in families.

11 SEPTEMBER

1831 Charles Darwin and Captain Robert Fitzroy travelled from London to Plymouth to inspect the HMS Beagle. This was Darwin's first sight of the ship on which he would sail during the voyage which will lead to his famous theory of evolution.

12 SEPTEMBER

1624 The second design of the first submersible (submarine) ever created was tested in the Thames in London, England.

13 SEPTEMBER

1922 The world's highest shade temperature was recorded at the African village of Al Aziziyah, about 40km south of Tripoli, the capital of Libya. Temperatures reached upwards of 58°C.

14 SEPTEMBER

2009 Microsoft launched Bing visual search.

15 SEPTEMBER

1616 The first free public school in Europe to allow non-aristocrats to attend opened in Frascati, Italy.

16 SEPTEMBER

1908 Automotive manufacturer General Motors was founded.

17 SEPTEMBER

1964 United Artists released the spy thriller Goldfinger, starring Sean Connery, to UK theatres. The movie would later become the first movie in the franchise to become an official box office blockbuster. Goldfinger was also the first Bond movie to feature an opening theme sung by a pop star, which would become one of the series' hallmarks.

18 SEPTEMBER

1830 In Maryland, Tom Thumb, the first locomotive built in the United States, lost a nine-mile race to a horse.

19 SEPTEMBER

- INTERNATIONAL TALK LIKE A PIRATE DAY

1928 The first talking cartoon film, Walt Disney's Steamboat Willie, premiered at the Colony Theatre in New York.

20 SEPTEMBER

1904 The Wright Brothers flew in a circle for the first time, in their Wright Flyer II.

21 SEPTEMBER

– AKA WIFE APPRECIATION DAY

1937 Allen & Unwin, Ltd. published the first edition of the fantasy novel, The Hobbit written (and illustrated) by South African born J.R.R. Tolkien, a professor at Oxford University.

22 SEPTEMBER

1999 An eBay member posted an online auction for five hundred pounds (227,5kg) of marijuana. Bidding reached US$10 million before eBay officials closed the auction down.

23 SEPTEMBER

1848 John Curtis produced the first commercial chewing gum on a stove in his home in Bangor, Maine in the United States. He marketed the product as "The State of Maine Pure Spruce Gum."

24 SEPTEMBER

2007 The comedy series The Big Bang Theory premiered with the episode "Pilot." (No. 1). The series centres around two socially awkward physicists who share an apartment together and the blonde waitress who moves in across the hall from them.

25 SEPTEMBER

1928 The Galvin Manufacturing Corporation was founded and would later be known as Motorola.

26 SEPTEMBER

1973 A Concorde set a new record for crossing the Atlantic Ocean faster than any other plane in history.

27 SEPTEMBER

1937 The last Balinese Tiger was killed. (Lets hope the Rhino doesn't become a piece of trivia…)

28 SEPTEMBER

1928 Sir Alexander Fleming noticed a bacteria-killing mould growing in his laboratory. This discovery was later known as penicillin.

29 SEPTEMBER

1916 John D. Rockefeller became the world's first billionaire.

30 SEPTEMBER

2005 California governor, Arnold Schwarzenegger, signed a bill into law that made Phishing a civil offense, leaving violators liable for actual damages or US$500,000 per violation, whichever was greater. The law, while widely criticized for being "too little, too late," was nonetheless the first effort of its kind to address the issue of widespread email fraud. WN

Robots vs Humans

So when I do melt down or have a complete and utter breakdown; will there be a faster, brighter and better Stepford version of me waiting in the wings? My husband probably hopes so!

BY | ANGELA PRICE

Honestly it boggles my brain, and frankly I find it all very unsettling. Possibly I have watched a few too many Transformer movies (Rise of the Machines); or it could have been watching the Stepford Wives when I was too young that scarred me for life. The idea that we could be duplicated and 'replaced' by a better, synthetic substitute - nightmare material in my mind.

My doctor used to have a sign outside his office that read *"Medicine, the only profession that labours incessantly to destroy the reason for its existence."* I can't help but wonder if in years to come there will be a sign hanging on the wall at some Artificial Intelligence Head Quarters that reads *"Mankind, the only species that successfully invented itself out of existence"*.

I'm a simple kind of gal at heart and all this technology and development unnerves me. It's all so complicated, so multilayered; evolving faster than anyone could ever have imagined. It also seems to be inevitable, like we can't turn the tap off even if we wanted to. Perhaps it is our destiny to invent ourselves out of existence - we would most certainly go down in history as earth stupidest inhabitants, ever.

No doubt you techy types think that I am completely naïve and getting carried away with myself, maybe I am, I'll happily own that. But I can't help be concerned about the way I see things moving and more worriedly, the pace I see it all moving at - pretty soon the only ones able to keep up this speed will be robots! At least they don't need to sleep - don't suffer meltdowns like we do. If they should happen to malfunction, they can be speedily fixed or replaced by a faster, newer model *(Stepford wives flash back moment happening here….)*

Take the simple cell phone as an example - well, one can hardly call them simple these days!

My first cell phone was exciting, but simple. I could make calls, send text messages and play one game (called Snake). Now my whole life seems to be governed by my cell phone. Emails, WhatsApps, smses and diary reminders constantly beep and ping at me; when it's not ringing that is - secretly I often wonder if my phone model is waterproof, because the day is coming when I'm going to flush it down the toilet.

I recall a time (pre-cell phones) when I was fully present and mindfully in a moment, not constantly multitasking because technology enabled me to. Think about it - back then, if I wanted to invite you to dinner I sat down at my home phone (which was not portable), with my diary in hand (a physical, paper one) and called you to chat and arrange a date. I heard your voice and we would really communicate. I was required to be mindful and fully present in the moment.

Unlike today.

Today I sent a WhatsApp whilst talking to my kids (bad mom); moved on to another task; got interrupted by a diary reminder ping, forgot why I picked up the phone in the first place; started driving to an appointment, got a WhatsApp in return which I read whilst sitting at the robot/ traffic light, start driving again trying to juggle dates in my mind - not really paying attention to what I was doing; tried typing a reply whilst sitting at the next robot; got irate because my predictive text kept spelling my name as bog not ang; deleted it five times, missed the lights changing and got hooted at. The result? I felt flustered, frazzled and two steps closer to that melt down. Has technology really helped me to function faster, smarter and more efficiently - thereby freeing up my time? I don't think so, it's driving me nuts.

So when I do melt down or have a complete and utter breakdown; will there be a faster, brighter and better Stepford version of me waiting in the wings? My husband probably hopes so! wn

calendar

SEPTEMBER | OCTOBER | NOVEMBER

SEPTEMBER 2015

9-10	Environmental Crimes Conference	Johannesburg	www.intelligencetransferc.co.za
9-10	Fundamentals of Power Distribution	Johannesburg	roberto@saiee.org.za
9-10	Fundamentals of Power System Calculations	Johannesburg	roberto@saiee.org.za
10-11	Generators Power Conference	Johannesburg	www.mongirosicommunication.co.za
15-18	Bauma ConExpo Africa 2015	Nasrec, JHB	www.bcafrica.com
16-18	Fundamentals of Long Term Evelution Mobile Communication	Johannesburg	roberto@saiee.org.za
17	Power Transformer Unit Protection and Testing	Johannesburg	roberto@saiee.org.za
18	Power Transformer Operating & Maintenance	Johannesburg	roberto@saiee.org.za
21	64th Bernard Price Memorial Lecture - Sustainable Engineering	Central Centre, Freestate	geyerg@saiee.org.za
21-22	New Engineering & Construction Contracts Course	Johannesburg	roberto@saiee.org.za
21-22	Advanced Microsoft Excel for Engineers	Johannesburg	roberto@saiee.org.za
22	64th Bernard Price Memorial Lecture - Sustainable Engineering	Southern Cape Centre, George	geyerg@saiee.org.za
23	64th Bernard Price Memorial Lecture - Sustainable Engineering	Western Cape Centre	geyerg@saiee.org.za
28	64th Bernard Price Memorial Lecture - Sustainable Engineering	Eastern Cape Centre	geyerg@saiee.org.za
29	64th Bernard Price Memorial Lecture - Sustainable Engineering	KZN Centre	geyerg@saiee.org.za
30	64th Bernard Price Memorial Lecture - Sustainable Engineering	Gauteng	geyerg@saiee.org.za

OCTOBER 2015

3	SHELL ECO Marathon - Registrations are open!!	Zwartkops, Johannesburg	estherk@uj.ac.za
4-7	SAIEE National Student's Competition	Bloemfontein	www.saiee.org.za
7-8	Design of Economical Earthing Systems for Electrical Installations	Johannesburg	roberto@saiee.org.za
7-9	Fundamentals of Long Term Evelution Mobile Communication	Johannesburg	roberto@saiee.org.za
11-13	FILTECH 2015	Cologne, Germany	www.filtech/de
14-15	Effective Technical Document Writing For Engineers	Johannesburg	roberto@saiee.org.za
14-15	Core Financial Management for Engineers	Johannesburg	roberto@saiee.org.za
19-21	Fundamentals of MV Protection	Cape Town	roberto@saiee.org.za
21-22	Fundamentals of AC ARC Furnace Electrics	Johannesburg	roberto@saiee.org.za
21-22	HV/MV Circuit Breaker, Maintenance, Safe Operation & Theory	Johannesburg	roberto@saiee.org.za
21-23	SSA Power Summit	Cape Town	www.ssapower.com
26-30	CIGRE Symposium	Cape Town	www.cigre.org

NOVEMBER 2015

7	SAIEE Annual Banquet	Johannesburg	geyerg@saiee.org.za
11-12	Photovoltaic Solar Systems	Johannesburg	roberto@saiee.org.za
18-19	Leadership & Management Principles & Practice In Engineering	Johannesburg	roberto@saiee.org.za
25-26	Fundamentals of Power Distribution	Johannesburg	roberto@saiee.org.za
25-26	Arc Flash & Low Voltage Conference	Joohannesburg	www.idc-online.com

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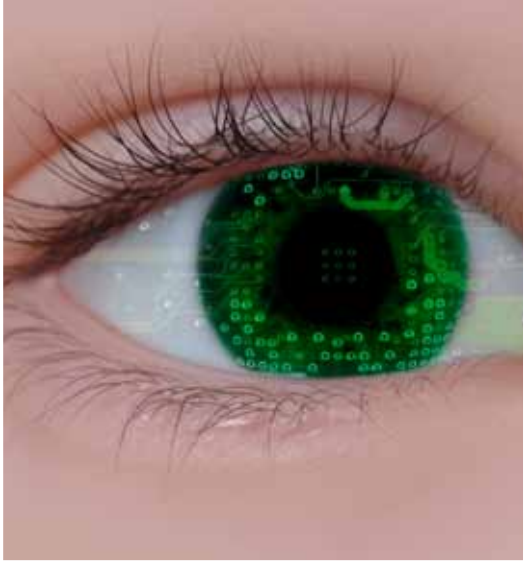

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