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CAD REPORT
Lessons learned from the CAD industry's wrong turns of the past

SIMULATION
Leveraging FEA to realistically simulate vehicle crash tests

INNOVATION
Pairing industry with university researchers to drive innovation

HOW SDRS HELP SOLVE IIOT CHALLENGES

SOFTWARE DEFINED RADIOS OFFER A WIDE TUNING RANGE, HIGH BANDWIDTH AND LOW LATENCY PERFORMANCE.

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+ Secondary encoders for position measurement

High accuracy for industrial robots

Having an additional, high-accuracy angle encoder on every robot axis can create significant improvements in absolute position accuracy. Mounted downstream from the motor's gear system, secondary encoders measure the actual position of each robot joint. Ideal solutions for this role are modular angle encoders, such as the WMRA from AMO with inductive scanning and the MCR 15 from RSF with optical scanning. They are the perfect choice for large shaft diameters and challenging mounting spaces.

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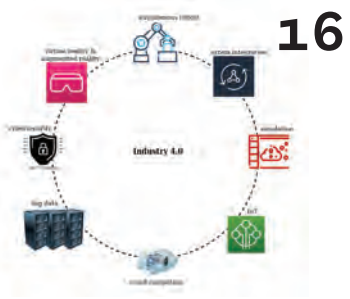

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Here Today...

As Ralph Grabowski's story illustrates in this issue, innovations in the CAD industry – once lauded as "must haves" – can dwindle from their former glory. Back around the late 2000s, Product Lifecycle Management (PLM) was the mantra of nearly every CAD software CEO and marketing department. Fast forward 10+ years, plus a few disastrous, multi-million dollar installations, and the concept has come to signify cloud-based PDM and engineering Software as a Service (SaaS).

More recently, terms like blockchain and metaverse quickly rose and fell while the buzz around terms like digital thread, digital twin, big data and artificial intelligence are still ramping upwards. According to Bloomberg, S&P companies have mentioned 'AI' more than 1,000 times on earning calls so far this year, a 64% increase from 2022.

And the push to digitize and optimize is showing up everywhere. The NFL, for instance, recently announced that building its 2023 game schedule required 4,000 instances of Amazon's EC2 virtual servers to compile. That's 272 match-ups over an 18 week period, taking into consideration things like travel requirements, primetime games, free agency, division rivalries, etc.

In total, the sports league's schedule makers said the system factors in more than 20,000 rules to arrive at, out of countless permutations, "the one" schedule that satisfies team owners, networks and all involved. Overall, Amazon says the league has saved $2 million processing their schedule through its systems.

I don't pretend to understand the myriad factors that go into an NFL schedule. However, I also wouldn't venture to guess how much tapping into 4,000 virtual servers for hours at a time, over a month or more, might cost. Rough estimate: not cheap. It's hard to swallow that the NFL is saving money on the deal.

Nor is it clear all that hardware is strictly necessary. According to Sports Illustrated, Major League Baseball relied on a married couple, Henry and Holly Stephenson, to schedule 2,430 total games over its 26 weeks season for more than 20 years, first by hand and later using a desktop computer running software the couple coded themselves.

Technology for its own sake, or in response to hype, is never a good idea. According to Harvard Business Review, multiple academic and analysts studies have found that 70% to 95% of digital transformations fail to meet their original objectives. A statistic like that suggests the underlying technology and the payback for it, are still unclear. The great thing about big players is they can throw money at the problem until proven use cases become obvious, or never materialize.

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New Automation Technology **BECKHOFF**

UWATERLOO-DEVELOPED SMART FABRIC RESPONDS TO TEMPERATURE AND ELECTRICITY

Researchers at the University of Waterloo announced the development of a smart material that is activated by both heat and electricity, making it the first to respond to two different stimuli. Composed of polymer nano-composite fibres from recycled plastic and strands of stainless steel, the programmable fabric can change its color and shape when either stimuli is applied.

According to the development team, the fabric opens a variety of applications, including clothing that warms up in response to cold temperatures and vehicle bumpers that return to their original shape after a collision.

"As a wearable material alone, it has almost infinite potential in AI, robotics and virtual reality games and experiences," said UWaterloo chemical engineering professor, Dr. Milad Kamkar, who also serves as director of the Multi-scale Materials Design (MMD) Centre at Waterloo. "Imagine feeling warmth or a physical trigger eliciting a more in-depth adventure in the virtual world."

Technically speaking, the Waterloo smart material melds two types of stimuli-responsive materials (SRMs): Shape memory polymers (SMPs) – which have a permanent and a temporary shape depending on a specific stimuli – and Thermochromic colorants (TCCs) – which change color based on temperature.

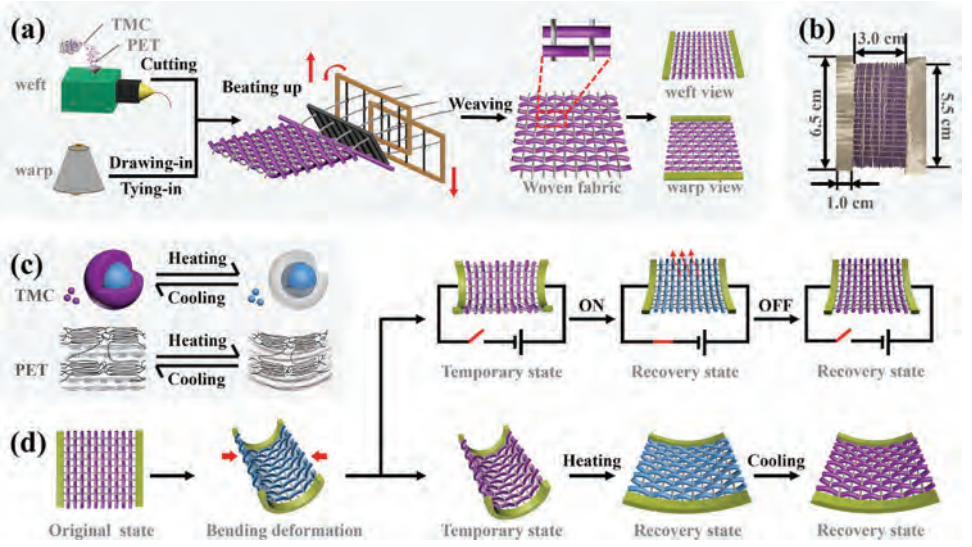
Employing a melt-spinning process, the UWaterloo team formed metallic composite yarns and thermochromic fibers. Weaving them together allowed the researchers to compose a multi-responsive smart-fabric that transforms from a predefined structure to its original shape while also changing color when exposed to heating or an electric field.

The researchers also created a device similar to a traditional loom that allows the fabric's shape and color change to be 'programmed' by controlling the micro-scale design of the fabric's individual fibers. As a result, parts of the fabric can be locally activated by applying a controlled voltage to any part of the fabric.

In addition to its programmability, the smart fabric needs only 5V to activate, less than other smart fabrics. In addition to improved energy efficiency, this lower voltage requirement makes the material suitable for smaller, more portable devices, including biomedical devices and environment sensors.

The researchers say the next step will be to improve the fabric's shape-memory performance with the aim of constructing a robot that can carry and transfer weight. A paper on the research, Multi-Stimuli Dually-Responsive Intelligent Woven Structures with Local Programmability for Biomimetic Applications, recently appeared in the journal *Nano-Micro Small*.

https://uwaterloo.ca



University of Waterloo's multi-stimuli-responsive material changes color and shape when exposed to heat or electricity.

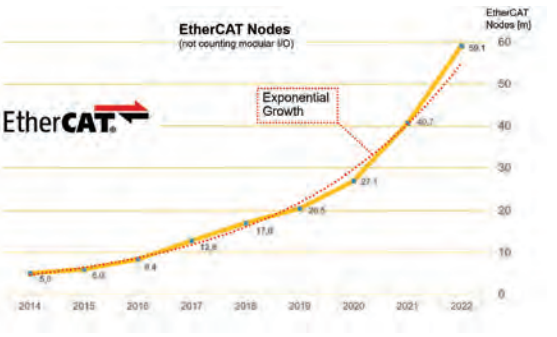
ETHERCAT GROWS TO ALMOST 60 MILLION NODES

The EtherCAT Technology Group (ETG) announced that the protocol it oversees grew to 59.1 million nodes in 2022, adding 18.4 million nodes in last year alone.

To tabulate its count, ETG only included EtherCAT chips sold in a respective year, excluding chips for I/O terminals. A modular I/O station, for example, was only counted as a single node, even if it consists of many more EtherCAT terminals. Even so, growth of the fieldbus technology, except for 2019, has been exponential for several years, said Martin Rostan, executive director of the ETG.

"Three years ago, we still believed in an upward outlier, but now the trend has solidified: The exponential growth continues," Rostan says. "The Asian market is developing the fastest, especially in China. But EtherCAT is also making better and better progress in North America. And in Europe, where the technology has its origins, EtherCAT has been going strong for quite some time."

ETG licenses EtherCAT on the behalf of Beckhoff Automation and, similar to CAN, requires only the chip manufacturer to



Photos: University of Waterloo, EtherCAT Technology Group

license their hardware. Beckhoff finances the ETG with the chip license income.
www.ethercat.org

TYTO ROBOTICS RECEIVES $400K GRANT FROM CRIAQ

Gatineau-based aerospace company, Tyto Robotics, announced it has received a $400,000 investment from the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ) to develop test equipment for large propulsion systems.

According to the company, a major barrier to adoption of eVTOL propulsion is the limited aircraft flight time, caused in part by limited battery capacity and unoptimized propulsion systems. Another is the uncertainty surrounding the powertrain components that prevent mid-air failure.

The goal of the project, the company says, is to develop test equipment that can be used by manufacturers in the heavy-lift cargo drone and eVTOL vehicle industries to test their propulsion systems and find the most efficient combination of motors, propellers and electronics.

The R&D portion of the project will be conducted in collaboration with Mejzlik Propellers of Czechia and l'Université de Sherbrooke of Quebec. Tyto Robotics will design a thrust stand capable of testing motors for large cargo drones and electric vertical takeoff and landing (eVTOL) vehicles, up to 500kgf of thrust and 320 kW of power.

In partnership, Tyto Robotics and Mejzlik Propellers will perform tests on powertrain components used on eVTOL aircraft to study how factors like motor Kv, voltage and propeller finish affect overall performance and reliability.

Concurrently, the team at l'Université of Sherbrooke will design an AI model capable of predicting a propulsion system's performance based on machine learning from data generated by the physical tests.
www.tytorobotics.com
www.mejzlik.eu

3D SYSTEMS VERIFIES PERFORMANCE OF NASA'S SUPER ALLOY ON COMMERCIAL PRINTER

3D Systems announced it has verified the properties of NASA's GRX-810 super alloy using the company's Direct Metal Printing (DMP) process. According to the company, demonstrating the performance of the material across different equipment and processing parameters opens the door for GRX-810 to be used in various aerospace components that require superior performance to traditional nickel-based superalloys.

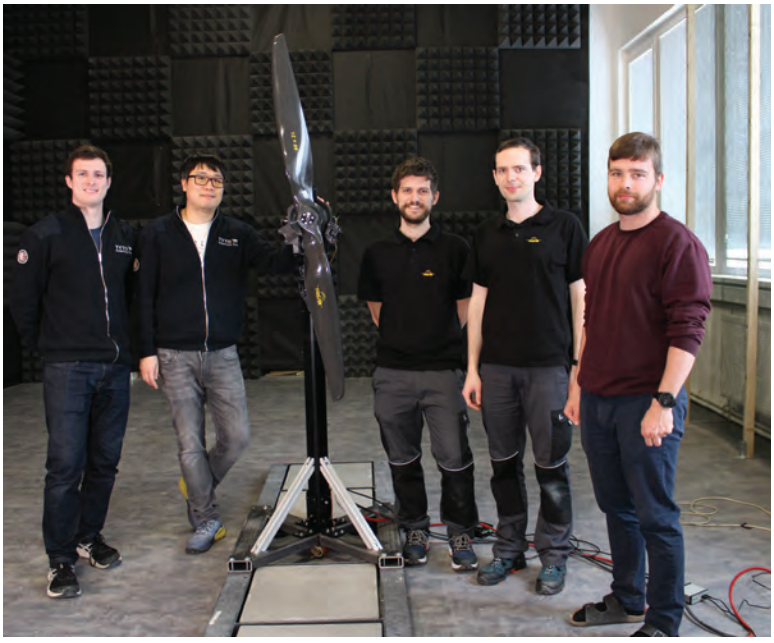
NASA logo printed from the space agency GRX-810 super alloy.

"The successful verification of the reported NASA GRX-810 properties is a testament to the incredible potential of this new super alloy, not only in its performance but in its capability to be produced repeatably," said 3D Systems' VP of aerospace and defense segment, Dr. Michael Shepard.

While the alloy's discovery was announced last year, NASA, in conjunction with Ohio State University, recently published a peer-reviewed paper in the journal Nature detailing the super alloy's metallurgy and performance characteristics. According to the authors, the NASA-developed superalloy has twice the tensile strength, over 1,000 times more creep strength and twice the oxidation resistance compared to other superalloys at temperatures up to 1,093°C (2,000°F).

"This superalloy has the potential to dramatically improve the strength and toughness of components and parts used in aviation and space exploration," said Dr. Tim Smith of NASA's Glenn Research Center, who is lead author of the Nature paper and inventor of GRX-810, along with Glenn colleague Christopher Kantzos.

According to the NASA paper, GRX-810 owes its resilience to its oxide dispersion strengthened (ODS) composition. Guided by prior research, NASA researchers used the laser powder bed fusion (l-pbf) AM process to



Engineers from Tyto Robotics and Mejzlik Propellers at Mejzlik's facility in Czechia

Photos: Tyto Robotics, NASA/ Jordan Salkin

coat NiCoCr metal powder with nano-scale oxide particles. The NASA team also employed computer model-driven alloy design to optimize the formation for high temperature applications.

The result is a combination of strength, ductility, creep life and heat resistance, the researchers say, that make GRX-810 ideal for applications such as rocket engines, turbine blades and exhaust nozzle components.

www.3dsystems.com

RESEARCHERS DEVELOP FINE FLOW CONTROL OF SOLENOID VALVES

Researchers at Germany's Saarland University announced the development of solenoid valve technology that allows for a high level of flow control but without requiring expensive sensors and with little energy input. While solenoid valves are fast, reliable and widely used, they are typically either fully open or abruptly shut. Making them hold a position, or precisely refine their operation, requires continuous energy input or a complicated series of sensors and control system.

To get around these limitations, the valve technology developed by the Saarland University group, headed by Professor Matthias Nienhaus, employs a magnetically conductive metal pin in a coil of wound copper wire and a small microchip within the drive electronics. By evaluating the current that flows through the coil to move the valve piston, the researchers say they can detect the position of the piston and control it quickly and accurately.

"We monitor the inductance," explains doctoral student Niklas König, who is researching this process as part of his doctoral thesis with Matthias Nienhaus. "We analyze the flow of the current in the winding over time. What that means is that we measure voltage and current, look at fluctuations over a certain period of time, analyze them and use them to observe the magnetic state."

Saarland University doctoral student, Niklas König, researches technology that controls valves and locking devices without the need for additional sensors.

The magnetic state, and thus the current fluctuations, change depending on where the piston is at any given time, König adds. 'This enables us to know precisely where the piston is. Using this information, we can control the position of the pin efficiently and precisely."

The result, he says, is that the continuously adjustable piston can move back and forth slowly or quickly as required, can hold any position and can return softly to its stop position if desired. In addition, the researchers say their algorithms allow for different piston positions to be programmed or to monitor whether a specific position is maintained, for example whether the valve is actually closed.

The group's research was funded by the German Ministry for Economic Affairs and Climate Action (BMWK). The microchip was developed in collaboration with the Fraunhofer Institute for Microelectronic Circuits and Systems (IMS) in Duisburg.

www.uni-saarland.de/en/

MAGNA AWARDED EDRIVE BUSINESS BY GLOBAL OEM

Magna announced it has been awarded a high-volume contract with an unnamed European OEM to supply its eDrive system (eDS Mid). Production of the high-speed e-motor is expected to begin in 2026 and to begin showing up in 2027 model SUVs/sedans.

Magna's eDS Mid offers a scalable power range from 100 to 140 kW, optimized for 800V. As a high-voltage eDrive system for electric AWD applications, it enables fast reconnecting through a new decoupling system and integrates a highly-efficient silicon carbide (SiC) inverter.

According to the company, it also delivers up to 2,000 Nm of torque but weighs less than 72 kg, delivering less weight and volume in packaging compared to other available products in the market, the company says.

"This new business marks an important milestone in our electrification strategy as we continue to consistently pursue new innovations and solutions to drive the rapidly growing EV sector forward," said Diba Ilunga, President Magna Powertrain.

Production of the eDrive system will be at the company's powertrain facilities in Kechnec, Slovakia and Lannach, Austria.

www.magna.com

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Whatever happened to...?

Lessons learned from the CAD industry's wrong turns of the past.

BY RALPH GRABOWSKI

For some CAD vendors, the tides of time wash away the plans for their future, no matter how well-executed. In 38 years of writing about computer-aided design, I've seen numerous companies disappear, perhaps through acquisitions, or else crushed by competitors, and even through pivots by the market.

Some – like the nVidia of the 1980s, Artist Graphics – were the giants of their times who threw the biggest parties at CAD conferences. My favorite: The long desert-only tables served on the Queen Mary. Today, the Internet has almost no record of that company from Minneapolis that invented the first proprietary graphics chip.

So, why should we care about companies that no longer exist? Failure does a better job of teaching us lessons than successes do. The outcome of failure helps guide our thinking on the probable trajectories of today's hot-or-not technology. It also helps us look past the marketing reassurances that these newly-launched products are the most important things ever. Until they're not.

Let's look at the trajectories taken by several different CAD products.

Rejection: Artist Graphics

The first personal computers had miserable graphics, with the original IBM PC offering just 640x480 resolution in a single color. The huge demand from CAD users for huge resolution led to companies like Artist Graphics, Nth Graphics and Vectrix making fistfuls of money selling high-end boards at an inflation-adjusted equivalent today of $10,000 and more.

Worse, each monitor had to match each graphics board's sync exactly, making both of them proprietary: Changing the graphics board meant spending another couple thousand on another matching monitor. The game collapsed when NEC released the first multi-synchronization monitor. Then, companies like nVidia and ATi (today AMD) emerged to offer low-cost graphics boards and the switch to software-based display-list processing. Artist Graphics spent too much developing their next-generation graphics chip and by 1995 became bankrupt.

Lesson Learned: Being first and holding the best parties doesn't preserve your place in the market. Stay paranoid by viewing your competitors as better than yourself, and by maintaining a keen awareness of changes happening to your market.

Sketching a new helmet design with Solidworks Industrial Designer

Reinvention: Autodesk Nexus PLM

Carl Bass, who was CEO of Autodesk in the years around 2010, considered PLM a joke, initially. Product lifecyle management had been invented by large CAD vendors to get customers to pay for a lifetime of software and services, well beyond the purchase of only drafting programs.

In 2011, Mr. Bass changed his tone. Autodesk would have PLM, it would be cheap, run on existing Vault data management software, share data through the online

Photo: Dassault Systemes

Buzzsaw application, ensure zero customization through hundreds of specialized modules, and be named "Autodesk Nexus 360 for PLM." As Autodesk saw it, this was in tune with what customers wanted.

Over time, Autodesk changed the underlaying technology, and changed the Nexus 360 name to Autodesk PLM 360, then to Fusion Lifecycle, then to Fusion 360 Manage. Today, Vault is still around, and is sold as both PDM (product development management) and PLM software; Buzzsaw is long gone; and customization is required through programming in Forge (renamed Autodesk Platform Services).

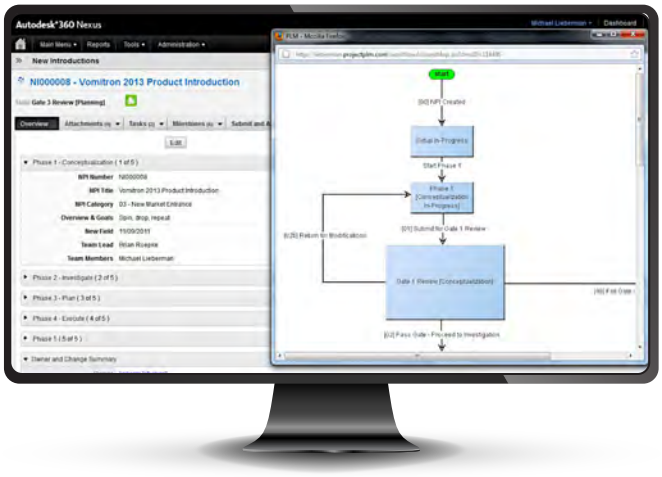
Lesson Learned: What companies think precisely fits the need of customers is not necessarily what customers think they need. When you get it wrong, the product can be corrected, but at the price of customer confusion over product naming and capabilities. And so to this day, Autodesk is a smaller PLM player relative to its size in the CAD market.

Misdirection: Solidworks Mechanical Conceptual and Industrial Designer

Dassault was smart when in 1997 it paid $310 million to acquire Solidworks. It became the world's most popular MCAD program, today generating over a billion dollars a year in sales. For a long time, Dassault left Solidworks alone, but then those millions of users became too tempting a target to ignore. They needed to become users of Dassault's own software, because it cost more, and more cost equals higher revenues.

In 2013, Dassault introduced Solidworks users to the first two programs based on its own software: Solidworks Mechanical Conceptual and Solidworks Industrial Designer. Despite the name, the two had nothing to do with Solidworks, and were based on technology inherently incompatible with Solidworks.

Dassault spent the next decade repeatedly reintroducing variations of its software to the collective yawns of users, and always appending the Solidworks name,



Administrator graphically customizing a workflow in Autodesk's Nexus 360.

Photo: Autodesk

such as this year's Collaborative Designer for Solidworks. How collective is the yawn? So far, 3% of Solidworks users have taken up Dassault's offerings.

Lesson Learned: Spending a decade unsuccessfully pressing your round peg into an acquisition's square hole means it's time to concede. Either spin off that balky acquisition, or else make it a fully independent subsidiary.

Misapplication: Mobile CAD Apps

Following the launch of iPad in 2011, the future of CAD was to run it on smartphones and tablets, clearly. We would now carry all our drawings with us; it was the end of paper in the field! After all, games and texting worked so well that they were becoming addictive. But not so for CAD.

Many mobile CAD apps appeared in the mid-2010s, from free to expensive. For a time, for instance, IMSI sold its TurboApp for $999, the maximum allowed by Apple store. But after the initial swell of excitement, using a finger to jab at small screens with operating systems unfriendly to the needs of CAD didn't cut it.

There were also problems with limited RAM, the lack of on-board vector processing and mud-unfriendly hardware. To customers, the value of mobileCAD came close to zero; developers couldn't sustain themselves on nearly-zero income. Companies dropped out; as the CEO of a competitor told me, "Why should we bother writing a DWG app when Autodesk already did it for us?"

Today, the CAD apps that remain are free, ad-supported or else bundled with annual subscriptions of desktop software.

Lesson Learned: It takes time to understand how new technology doesn't necessarily suit your vertical market. Today, everyone can be a first-mover with all the programming assistance available, so it pays to hang back and observe the impact of new tech on your competitors.

IMSI's mobile app, TurboViewer, debuted in the mid-2010s as part of the company's $999 TurboApp package.

Misjudged: Generative Design

Probably the most exciting technology in CAD has been generative design, which does what humans cannot: Output designs optimized for today's resource-limited world. This, surely, ought to be in every engineer's toolbox. Except it's not.

There are independent firms that offer the software (such as nTopology), and CAD software giants that offer it at extra cost. But when we look about, we don't see its results in new products. It's invisible.

One problem is that two technologies have the same name. One generates thousands of alternative designs, whose number overwhelms us ordinary humans.

Optimizing an airless tire design with nTopology's nTop software.

The other optimizes designs by removing unnecessary material, creating models that look ugly to humans, in my opinion. With the ongoing lack of interest, Autodesk, for instance, this year slashed the cost of its generative design extension from $1,280 to $320/year.

Lesson Learned: Customers may not appreciate otherwise-cool technology that adds extra steps and extra cost to product development. A certain level of design inefficiency is tolerated by the market.

These examples from history tell us about the future of new technology like AR/VR/XR/MR, AI, NFT, and DeFi. There is an initial exploration phase, in which all kinds of companies work to see how the tech fits: Firstly in their marketing plans, and then secondly into their products. Money is spent; money is lost.

The lesson is that new technology, which initially seems to overwhelm the world with its inevitability, always goes in one of two paths: it becomes an alongside technology, or it disappears. As I write this, corporations are going nuts over AI; eventually, it will fade into the background like the Internet itself, or else fall away like NFTs. **|DE**

Ralph Grabowski writes on the CAD software industry on his blog (www.worldcadaccess.com) and has authored numerous articles and books on CAD.

Photos: IMSI, nTopology

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PERFORM PHYSICAL TESTING ONLY ONCE

Quebec's Optimec Consultants leverages high-end FEA to realistically simulate vehicle crash tests.

For many in the engineering design industry, Finite Element Analysis may seem straightforward: Simplify and mesh the model, set material properties and boundary conditions, apply one or two static loads and let the solver do the heavy lifting.

While that may serve as a general description of the basic FEA many engineers employ on single parts, in reality, FEA is multi-layered discipline with widely differing levels of complexity. Move up to analyzing an assembly, for example, with its various joints, welds, fasteners and fuzzy boundaries, and the level of difficulty (and possibility of human error) scales considerably. Add in dynamic loads and/or non-linear behavior, and the challenge increases significantly again.

At the highest FEA level sits wildly chaotic scenarios, such as realistically simulating what happens to a vehicle during a roll-over or head-on collision. Such simulations must account for multiple dynamic loads applied over time to large assemblies that may contain hundreds of parts composed of everything from aluminum and steel to rubber and plastic.

Producing a realistic analysis of these applications requires sophisticated software tools that can crunch thousands of calculations to converge on a solution within a relatively short time frame. It also depends on highly trained specialist with expertise in, not only the software, but also intimate knowledge of the safety test conditions regulatory bodies require of vehicle manufacturers.

For more than 20 years, Laval, QC-based Optimec Consultants has been a trusted source of both: High-end FEA software and the engineering specialists to wield it. With experience in automotive, aerospace, industrial systems and consumer goods, the firm's clients include international firms such as ABB, Honeywell and Raufoss Technology, as well as Canadian companies such as Héroux-Devtek, Barrière QMB, Ker-Train Research and Dana TM4, among many others.

According to Optimec's lead Engineering Simulation Specialist, Benjamin Beckelynck, B.Ing., M.Sc., the firm's clients depend on his team to keep the expensive and time-consuming process of physical testing to an absolute minimum. For those in the transport industry, who must meet multiple Federal Motor Vehicle Safety Standards (FMVSS), the prospect of failing a physical test and having to crash a custom-built, million-dollar prototype more than once is a nightmare scenario.

"Failing an FMVSS test is major; the client would need to spend another million dollars to build another prototype," Beckelynck explains. "And then you need to wait for the test center to have availability to test again. The cost and all the production delays are major drawbacks. That's the idea behind virtual testing. If you do the virtual testing, you only have to go test once and you're good."

To perform those complex simulations, Optimec's preferred tool is Abaqus/Explicit, a version of Dassault Systèmes' SIMULIA software suite that specializes in dynamic, non-linear FEA applications. In addition to being

Photo: Pavel_Cha/Getty

Optimec Consultants' simulation of the Colorado Rack Test, using Dassault Systèmes' FEA software, led to a series of structural reinforcements that helped a bus manufacturer pass the FMVSS physical test.

as feature rich as similar software on the market, Beckelynck says Abaqus has the added benefit of being integrated with Dassault's cloud-based 3DEXPERIENCE platform.

Since many industry clients already use CATIA for CAD design, he says Optimec's analysts can leverage the 3DEXPERIENCE platform to create associative links to the original models in Abaqus. This streamlined workflow avoids the lengthy process of exporting and importing STEP or Parasolid files, required when using other FEA software.

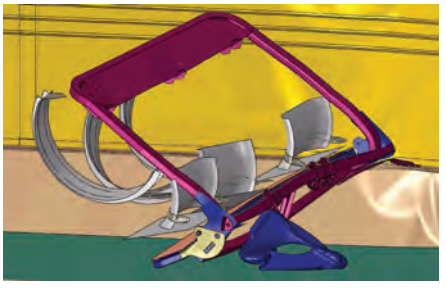
"It's common for a simulation to find a problem in a model that then has to be redesigned," Beckelynck explains. "Once this design is modified by the designer, the simulation process starts again. With third-party software, that means you have to re-mesh the model, re-prepare the analysis, run it, solve it and then probably find another problem and repeat the process again. This iterative process is so painful, because everybody is sending files to each other and you have to redo the same work several times."

"On the 3DEXPERIENCE platform, however, where everything is connected together, the designer's changes are connected to the mesh," he adds. "When you click update, the mesh is updated, and then you click run and you run the simulation again. As a result, the whole iterative process is much faster in an integrated environment."

While efficient, Abaqus/Explicit's true power, Beckelynck says, is demonstrated by how closely Optimec's simulations match results of real-word, physical testing. As evidence, he points to a series of simulations the company performed for a North American bus manufacturer that was developing an electric school bus model. Optimec was tasked with helping the bus maker modify its prototype in preparation for a number of FMVSS tests.

Those tests included the Colorado Rack Test, a standardized FMVSS test designed to validate the structural integrity of a bus in a rollover accident, as well as the regulatory agency's seat belt assembly anchorage test (FMVSS 210). In fact, it was a prior failure of both these physical tests that prompted the bus maker to contact Optimec in hopes of avoiding potential costly re-tests.

Instead of actually rolling a prototype, the Colorado Rack Test mimics the forces involved by actuating multiple hydraulic jacks positioned diagonally along the bus' interior. To pass, the actuators can't deflect more than 4 inches and the emergency exit must remain easy to open. Optimec's simulation of the test on the prototype bus replicated its prior failure and led to a series of structural reinforcement.



Simulation of the NHTSA's Seat Belt Assembly Anchorages test helped Optimec's client pinpoint and fix a failure of the bus seat's anchorage point to the bus wall, as well as several rivets in the floor.

Similarly, for the FMVSS 210 test, Optimec's simulation pinpointed failure of the seat's anchorage point to the bus wall, as well as several rivets in the floor and a potential failure of the seat itself, mirroring what occurred in the prototype's prior failed physical test. Based on the FEA results, the Optimec team recommended specific reinforcements to the rivet line, anchorage point and seat structure.

In both cases, Optimec's simulations of the modified designs predicted a successful test, which led to a subsequent passing grade on both FMVSS physical tests.

While this cycle of iterative virtual simulations informing targeted design changes in preparation for physical testing is a powerful, cost-saving tool, Beckelynck says an equally powerful capability of simulation goes largely under-utilized. Namely, feeding the results of a physical test back into the virtual simulation. By validating and refining the simulation accuracy with real word data, manufacturers then have the opportunity to explore multiple "what-if" scenarios not captured by standardized regulatory tests.

"We are passionate about what we do, and we want to help every customer we're working with," Beckelynck says. "By working with so many different customers, we have the chance to learn their product. Sometimes we know their product better than the designer, because we can visualize exactly how it's behaving under certain conditions: What is efficient, what is not efficient, what could be improved and what could be optimized. You can't get that with a physical test."

"Many know virtual tests can save time and money and reduce time-to-market because the iterative design process is much faster and much cheaper than doing physical tests," he adds. "What many don't realize is that, with an accurate enough virtual simulation, they will learn so much about their product and gain an in-house expertise, which is so valuable to improve the next design." **|DE**

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HOW SDRS HELP SOLVE IIOT SYSTEM CHALLENGES

Software defined radios offer a wide tuning range, high bandwidth and low latency performance.

BY BRENDON MCHUGH AND SIMON NDIRITU

The Industrial Internet of Things (IIoT) is gradually revolutionizing communication infrastructure in industry. Similarly, wireless systems are increasingly replacing wired solutions in various industrial systems. IIoT systems require low latency and tight synchronization to run, and often integrate software defined radio (SDR) to hit these technical requirements.

This article discusses the various capabilities of SDR systems that make them suitable for implementing IIoT solutions, including wide tuning range, high bandwidth, multiple-input multiple-output (MIMO) and low latency performance. SDRs also help solve various issues in industrial environments, such as frequency hopping, incompatibility of standards, inflexibility of wireless/networking equipment, and more.

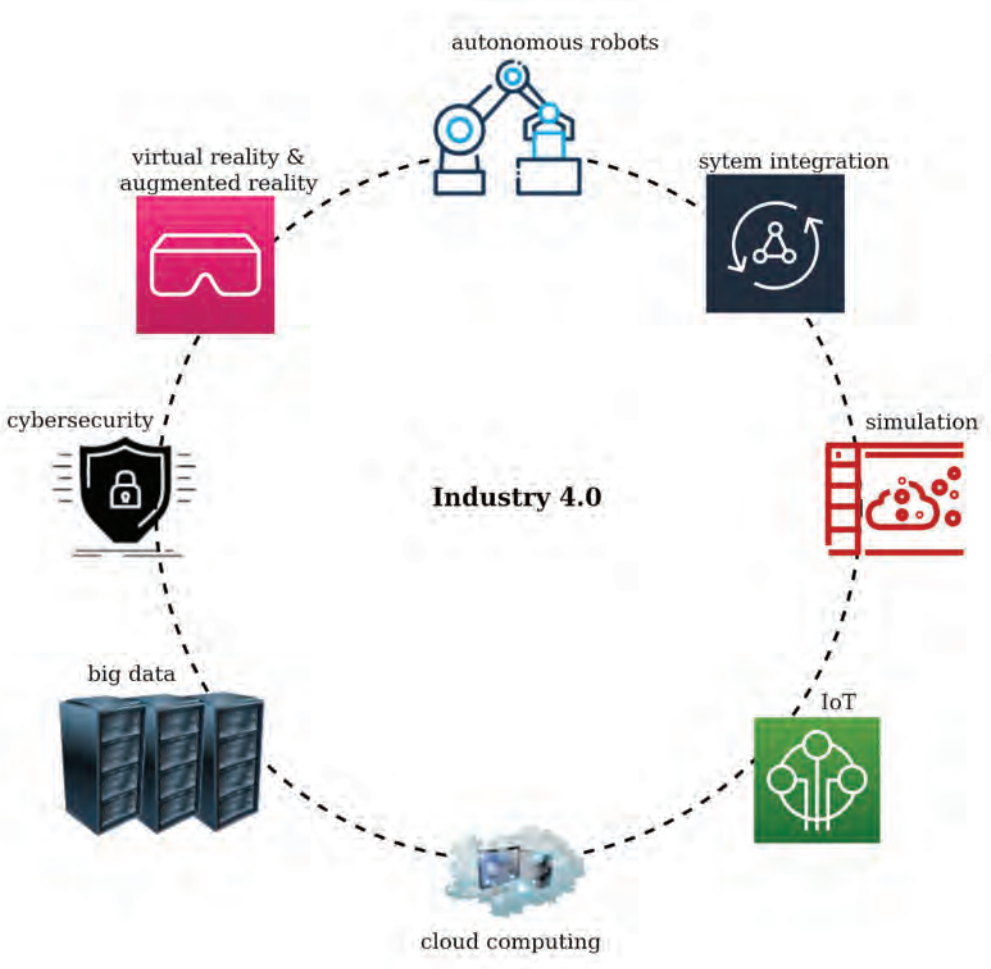

Figure 1: An overview of the technologies enabling IIoT.

IIoT ecosystem

IIoT is one of the key enabling technologies for Industry 4.0 – which entails use of data-driven assembly and production and massive use of sensors for data acquisition and network monitoring. This level of connectivity requires hybrid wireless sensor networks that are capable of interconnecting various devices including programmable logic controllers (PLCs), sensors and actuators.

Connectivity in conventional industrial environments is dominated by wired networks; however, most industries are switching to wireless infrastructure mainly because of their quick configuration, higher mobility and lower cost of installation and maintenance.

In addition to connectivity, quality control and productivity are critical issues in today's industries. IIoT employs smart devices and autonomous systems to enhance flexibility and efficiency in manufacturing processes. Moreover, IIoT systems feature a variety of analytics tools that provide the real-time

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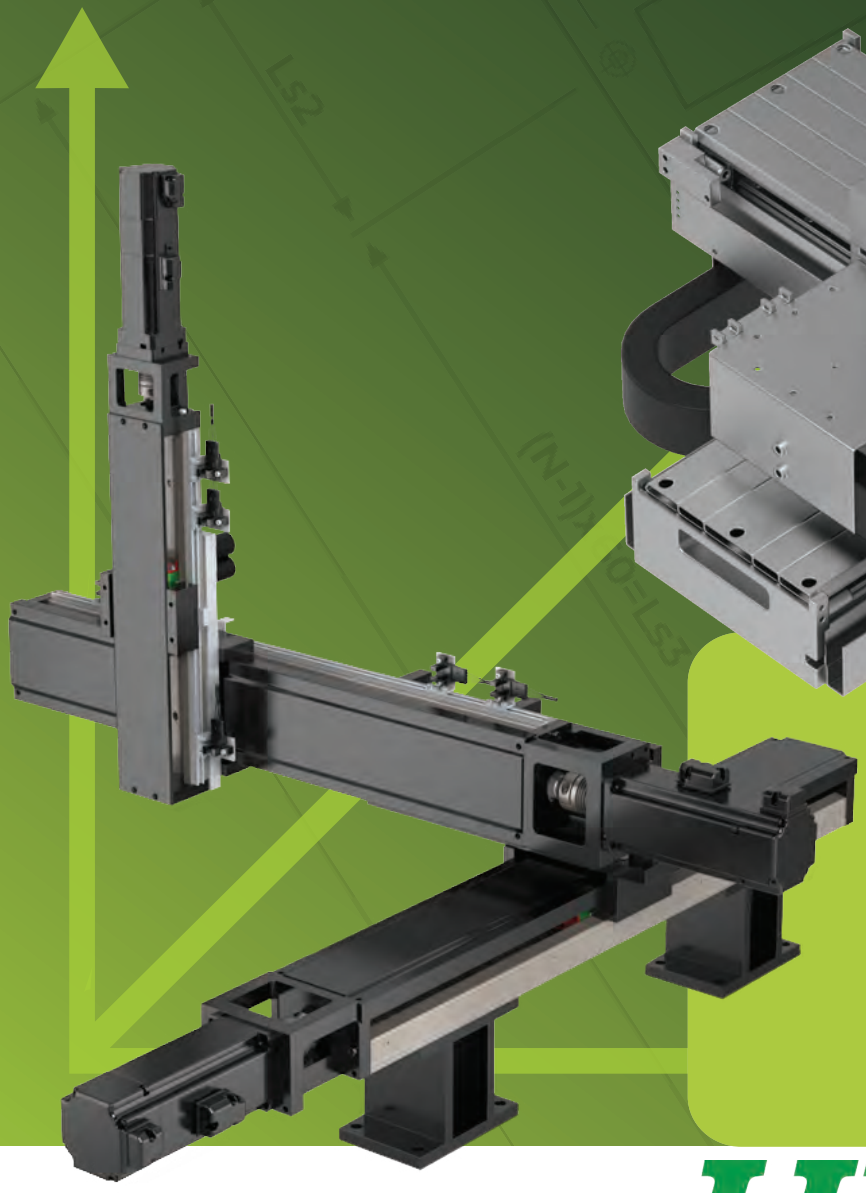

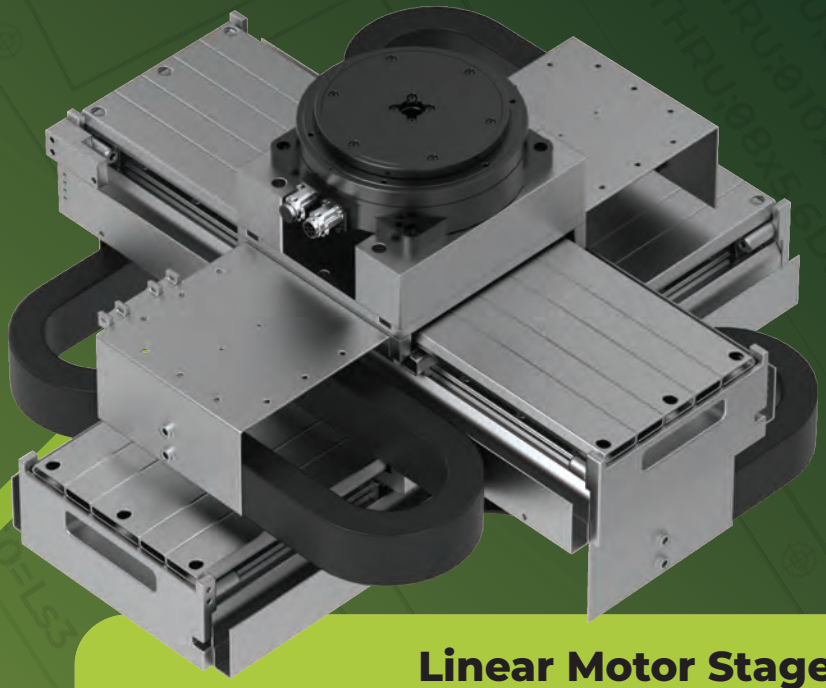

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insights required to enhance business agility. This allows employees to monitor and assess production and make modifications, if necessary, for supply and demand, specifications and other parameters.

The growth of Internet of Things (IoT) has helped accelerate adoption of wireless sensor networks (WSNs) in a variety of industrial applications including remote control, environmental monitoring, telecommunication and disaster detection. IIoT devices utilize a wide range of non-interoperable wireless links and protocols. These standards include Long Range (LoRA),Wi-Fi, Sigfox, 2G, 3G, Ingenu, Weightless, ZigBee, WirelessHART and Bluetooth Low Energy (BLE). As these standards evolve and advance in capability, the ability for radio and networking systems to adapt will be paramount to the success of IIoT implementations.

SDR systems

A typical SDR platform features a radio front-end (RFE) and a digital back-end. The RFE features transmit (Tx) and receive (Rx) functions and offers a broad tuning range, typically 0-18 GHz. The tuning range of best performance SDR systems can be extended up to 40GHz. Furthermore, the highest bandwidth SDR systems can offer an instantaneous bandwidth of 3GHz.

The back-end of an SDR platform features a field programmable gate array (FPGA) with a broad range of onboard DSP capabilities including modulation, upconverting and demodulation. The reconfigurability of these modules enables implementation of new radio protocols and digital signal processing (DSP) algorithms, which allows for flexibility and ability to keep up with technological advances.

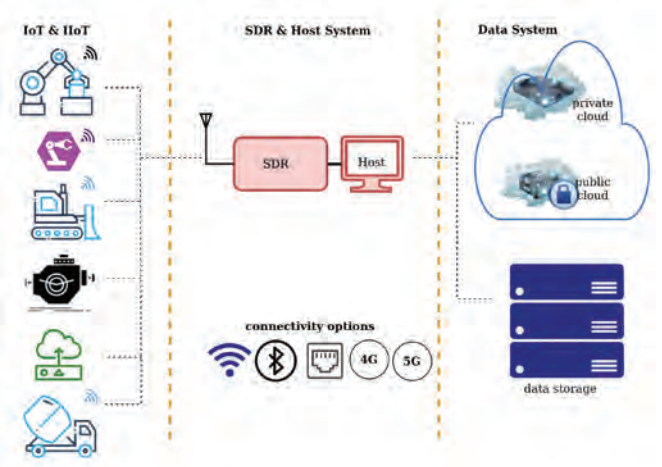

Figure 2: IIoT gateway based on an SDR system.

SDR platforms feature multiple Tx and Rx channels, with each of these independent channels featuring dedicated analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). Furthermore, high performance SDR platforms support a broad array of open source tool kits, such as GNU radio.

SDR platforms vary in size and complexity to meet the diverse needs of today's applications. The modular architecture of SDR systems allows more devices to be added by simply increasing the number of channels and allows for systems to be linked together for larger projects. This makes an SDR platform a cost effective solution for implementing scalable industrial solutions, such as ultra-high network backhaul systems.

SDRs for IIoT applications

One of the main challenges facing the realization of IIoT is incompatibility due to the lack of a unifying technology that can work with a broad array of regularly evolving standards. The flexibility and reconfigurability of SDR systems enable them to seamlessly support a wide variety of wireless technologies. Moreover, the performance characteristics of SDR systems make them suitable for implementing a broad range of industrial solutions including data aggregators, base stations and cloud and data center gateways.

Various SDR-based IIoT solutions have been implemented and have their performance tested to ensure successful operation before full-scale deployment. Tests with a prototype system, which was developed for routing data to and from a variety of IIoT devices utilizing different wireless protocols, such as ZigBee, LoRA, and BLE, have shown that these platforms are suitable for developing highly scalable gateways. The solution utilized an MQTT broker to enable IP-based packet transmission.

Some of the key parameters to consider when selecting an SDR system for IIoT applications include power, sensitivity, selectivity and phase noise. The range of an RF system is significantly determined by the power of the transmitter and the sensitivity of the receiver. Careful consideration is required since authorities restrict the maximum power that can be transmitted and high power transmission devices are usually expensive.

For instance, one particularly important parameter is the ability of a receiver to distinguish between a signal of interest and an unwanted signal, which is determined by receiver's sensitivity. Another related parameter is the capability of a system to receive a signal of interest when an unwanted signal is active in an adjacent channel. This is described in terms of adjacent channel rejection (ACR).

To achieve high blocking and selectivity figures, it is vital to ensure that the phase noise in the radio system is minimal. Phase noise is caused by short-duration fluctuations in a radio signal and is typically measured in dBc/Hz relative to the carrier. Minimizing phase noise induced by oscillators/synthesizers in a radio system is essential, particularly ones that are subject to vibration and other disturbances in an industrial environment.

The resilience of a receiver to nearby high power interference is mainly determined by its front-end linearity. The linearity of a receiver is usually given in terms of input third-order intercept (IIP3). This is critical in IIoT settings, where densely packed transmitters and power supplies are often causing interference among one another.

How SDRs are solving IIoT challenges

SDR platforms offer high flexibility and can support a wide range of wireless technologies, making them particularly suitable for use in applications involving real-time acquisition and

Photo: Per Vices

transmission of data. In addition, an SDR platform can operate over a broad range of frequencies, allowing one unit to replace many separate ones that operate over limited frequencies.

SDRs allow control and data links to be easily adapted to meet the conditions of a radio system. This means that parameters such as gain, error correction codes and filtering methods can be adaptively adjusted. Furthermore, the high flexibility of SDR systems allows wireless links to be configured individually depending on the operating conditions (for instance, meeting environmental standards including vibrations and temperature).

One of the techniques commonly used to avoid interference is frequency hopping, which is the repeated switching of carrier frequency during transmission to reduce interference and avoid interception. SDRs support frequency hopping and a variety of modulation schemes used in an IIoT environment

There is also a new SDR design that utilizes an FPGA instead of a general-purpose computer. This model-based architecture allows the system to perform fast signal processing and is particularly suitable for time-critical applications. Moreover, use of software-based modules in SDRs helps shorten the cycle of developing and evaluating new radio techniques.

Integrating an SDR system with software defined network (SDN) technology enhances network management functions and enables security and resource orchestration. This combination also offers high immunity to latency-related problems and is therefore suitable for time-critical applications. In addition, SDN is capable of reconfiguring a network to real-time predefined requirements, thereby enhancing the reliability of wireless communication systems.

In addition, SDR systems can be used for assessing the performance characteristics of wireless networks. A prototype solution that utilizes SDR technology and Precision Time Protocol (PTP) was developed to measure time-related metrics. Tests with this prototype showed that it was capable of providing precise measurements of jitter and time delay.

SDRs offer unique capabilities that make them particularly suitable for implementing IIoT solutions. These capabilities include a wide tuning range, MIMO channels, and reconfigurability. SDRs are capable of supporting a wide variety of wireless protocols used in IIoT applications and their reconfigurability enables easy implementation of new protocols and algorithms, which are integral in adapting to new technology and innovations. Furthermore, combining SDR and SDN technologies enables realization of robust low-latency radio solutions for numerous IIoT applications by functioning as a gateway for different low-power radio protocols. **|DE**

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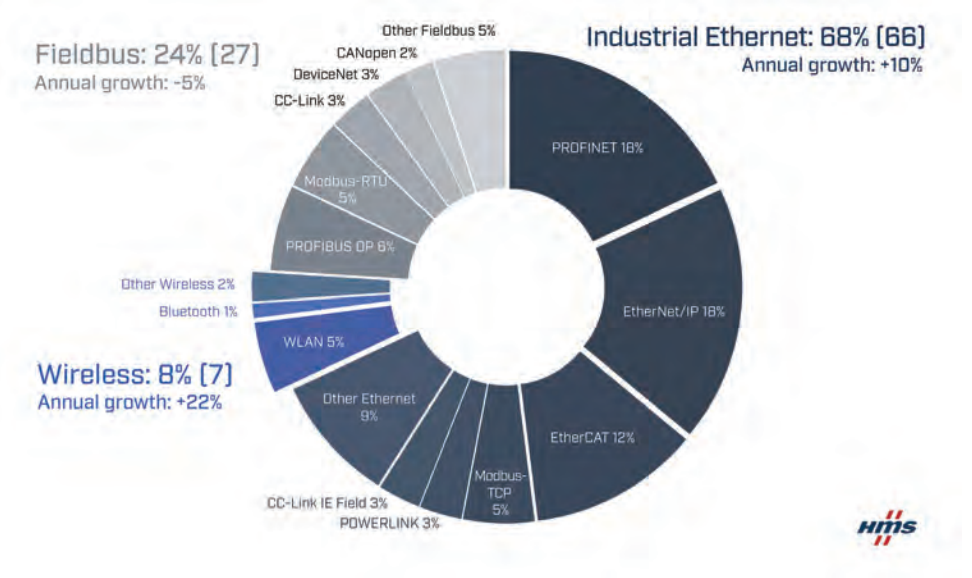
Brendon McHugh is a field application engineer & technical writer at Per Vices. Simon Ndiritu is an electrical engineer & technical writer. Per Vices offers high performance SDR solutions that are suitable for various IIoT applications.

THE STATE OF INDUSTRIAL PROTOCOLS

HMS Networks report details Ethernet protocol market share in 2023.

Each year, HMS Networks presents their analysis of the industrial network market, focusing on new installed nodes within factory automation globally. The Industrial ICT firm's 2023 study includes estimated market shares and growth rates for fieldbuses, Industrial Ethernet and wireless technologies. According to the study, industrial network market continues to grow, with total market growth expected to be +7% in 2023.

Industrial Ethernet continues to take market share, growing by 10%. Industrial Ethernet now makes up for 68% of the global market of new installed nodes in factory automation (compared to 66% last year). The head-to-head battle between PROFINET and EtherNet/IP continues as they lead the 2023 network rankings with 18% market share each. EtherCAT also continues to grow strongly and is now in a clear third place at 12% market share.



Fieldbuses are decreasing again

Despite the growth of fieldbuses last year, new fieldbus installations will decline by 5% in 2023 the study expects. PROFIBUS marginally leads the fieldbus rankings with 6% market share, closely followed by Modbus-RTU at 5%.

Together, fieldbuses account for 24% (27) of the market in 2023. Although the number of new fieldbus nodes are declining, a lot of devices, machines and factories will still be relying on the well-functioning and proven fieldbuses for many years to come.

Wireless grows fastest

The Wireless growth accelerates to +22% in 2023, as more wireless industrial networking solutions are introduced in factory automation. Typical use cases include cable replacement applications, wireless machine access and connectivity to mobile industrial equipment.

"Solid industrial network connectivity is key to achieve the manufacturing uptime which is needed to reach productivity and sustainability objectives in factory automation," says Magnus Jansson, Product Marketing Director at HMS Networks, Business Unit Anybus. "Quality, security, safety and gaining insights through device and machine data, are key drivers we see for the continued expansion of industrial networking."

Regional network variations

EtherNet/IP, PROFINET and EtherCAT are leading in Europe and the Middle East with PROFIBUS and Modbus-TCP as runners up. The U.S. market is dominated by EtherNet/IP with EtherCAT developing strongly and gaining market share. PROFINET leads a fragmented Asian market, followed by EtherNet/IP and strong contenders CC-Link/CC-Link IE Field, EtherCAT, PROFIBUS, and Modbus (RTU/TCP). **|DE**

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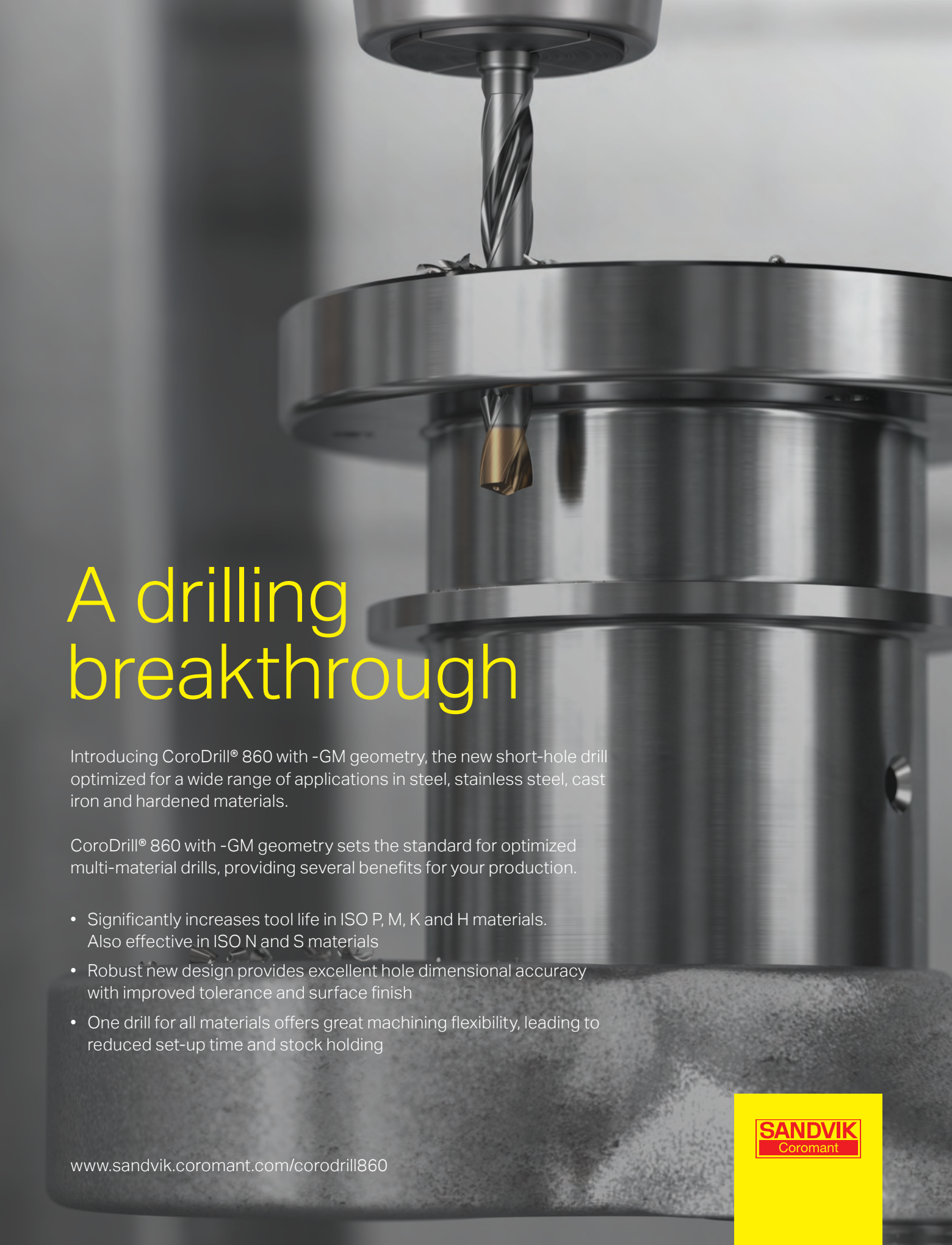

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R&D MATCHMAKER

Mitacs CEO, John Hepburn, explains how the not-for-profit pairs companies with Canadian universities to enable R&D and drive innovation.

The following is an edited version of a Design Engineering podcast interview with Mitacs CEO, John Hepburn. For the past 20 years, the Canadian government-funded, not-for-profit has paired private companies with research specialists at Canadian universities to perform R&D projects and drive innovation.

Photo: Getty/eyegelb

Q What is Mitacs an acronym for?

Hepburn: It's not an acronym anymore but commonly people still think it's an acronym. Originally, it stood for mathematics, information technology and complex systems. It started as a network of academic researchers, applied mathematicians and computer scientists studying standard academic problems.

Nearly two decades ago, however, Mitacs got into the business of promoting industrial connections and providing research internships for graduate students. So, we stopped being the academic network and transferred into being a not-for-profit dedicated to basically creating university/industry partnerships and driving those through student internships.

Q When you say student, do you mean just graduate students, or undergrads and professors as well?

Hepburn: It's all of the above. Mitacs started with an idea: Wouldn't it be great if high level academic talent, in other words PhD students, were made available

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to solve industry problems. And so that also involves then the research professor, because the idea of our internships is the student doesn't leave the university. I spent 18 years at University of Waterloo, so I know cooperative education programs inside and out. For those, the student leaves the university and goes and works in industry. And those are great – good for the student, good for industry.

Our programs are a little different in that the student, by contract with the federal government, never leaves the university. And so the work becomes incorporated into their research program as a graduate student. That's the classic Mitacs. The vast majority of what we do is Master's, PhD and postdoctoral students working on these shared cooperative research projects, with their supervising professor with an industry partner.

More recently, we've gotten into including professional students, in other words, business, community college, polytechnic and, very recently, undergraduate students. So we can work with students of any flavor or level, although most of the work is with more advanced students.

We're open as long as it's a partnership that promotes innovation in the non-academic partner and most of the work is with industry. But we also work with not-for-profits and municipalities. Mitacs basic idea is: How can we better exploit the talent and expertise that resides in our post-secondary institutions to solve problems outside of the academy.

Q So the allure for the industry partner is they gain access to technologies or talents they wouldn't necessarily have in house?

Hepburn: The big allure is talent recruitment and talent retention. As with a cooperative education program, industry gets to work with a very talented student who they can then employ once they graduate. So that's benefit number one. Benefit number two, which is the principal benefit during the internship, is the students are working on a real problem. Industry has something they can't figure out or something they need help figuring out. And the student provides a conduit to the post-secondary expertise and also the equipment that's available.

> ***"Canada doesn't have as innovative an economy and an industry base as I'd like to see. Yes, a company can make money without being very innovative, but I don't know if that's a good long term strategy."***

Our requirement is that the student has to spend roughly half their time at the University and half their time at the industry partner doing their internships. So they don't transfer entirely to the industry partner and they don't do contract research at the university. They do both. It's supposed to be a real partnership driven by this student internship.

It's also exceedingly low risk for the company. They aren't hiring the students or taking on the liability of having a research employee that they may not need for more than eight months. The only risk the company has is that they're paying for a fixed number of months of high quality student problem solving.

If it works out, then they may choose to take the student on or enter into a new research area. And, considering the quality of the talent, it's very low cost. I mean to pay $7,500 bucks for four months of a PhD level student with advanced training and just the area you need to help, not a bad price to pay.

Q Is there a typical time limit on how long projects can last?

Hepburn: The minimum is four to six months. A single internship unit is typically four months of work for a single student, but we have projects that have hundreds of internship units, spread over three years or more. So if there's a consortium of companies that wants a body of work done, or there's a big company that wants a body of work done, it's going to take three years and involve many, many students and postdoctoral fellows.

We take that in as a proposal, and we make a decision on the overall project. Then, as the project progresses, they'll identify specific students. We don't bill the companies until the student is identified, and we have a start date. Everything we do is very specific: For this four month period, this student is going to be working on the project, and then the company pays for that student and the money gets transferred to the university.

Q How are companies and researchers matched up?

Hepburn: Projects get developed in all sorts of different ways. Sometimes, Mitacs does the matchmaking. We have currently more than 100 business development professionals across Canada. So chances are, if you're an industry in pick-a-Canadian-city, and you've got a problem, our business development people can find out about this.

They are all always in contact with their local post-secondary institutions and local industry. They'll find out about problems that some industry potential partner has, and they'll say, 'We have just the professor and students at the local university or a university down the road, that are actually interested in the same problem.'

Sometimes, the university professor has a pre-existing partnership with a company. Sometimes the company gets created as a result of university discoveries, like it's a spin-off company of the university. So the potential projects come at us in many different ways, either driven by the professor and the students, or a company that was founded out of the university, or industry looking for somebody in the university could help them out. And the secret for us is the business development people are the ones who do the matchmaking and sort of shepherd the projects through to hopefully a happy ending.

Q *Is there a limit to how many projects Mitacs can take on?*

Hepburn: There is a funding limit; clearly, these things cost money, but we've got quite a good deal of money from the provinces and the federal government. Last year, we did 17,000 of these four month work units. Now, that's not 17,000 projects or 17,000 students, but it's getting on to 10,000 students, and it's getting on to several thousand projects. In fact, we've been doubling in size about every three years.

These projects range from a small company that needs a student for eight months to a dozen students and postdocs working for three years. So on average, we do several thousand of these projects a year. We work with 6,000 to 7,000 companies, most of them small-to-medium enterprises, which is the way the Canadian economy is structured. Even so, there are a lot more companies out there that could use the help and there are a lot of students out there who could use the experience.

Q *Are there common misconceptions that you run into?*

Hepburn: There are several misconceptions. One of the most common misconceptions is that PhD students aren't that useful to a company, because they're 'academic minded', they just want to be professors, they're 'kids'. We always find that, when the companies actually do take on one of these students, they discover that no, actually PhD students know how to solve problems.

Another misconception is that, because of the Mitacs acronym, we're just in the technology business, and we're only providing computer scientists and engineers. That is a large fraction of our business, but we can also provide social science students or, in some cases, humanities students. We can provide whatever talent a company needs; we're not just restricted to dealing with engineers and computer science.

And then finally, it's the notion of what it takes to be successful. Canada doesn't have as innovative an economy and an industry base as I'd like to see. And so I think it's just the whole notion that prosperity is linked to innovation. Yes, a company can make money without being very innovative, but I don't know if that's a good long term strategy. What we're trying to do is promote the idea that actually everybody's more prosperous and productive if they're more innovative. **|DE**

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Danfoss Power Solutions has launched its Aeroquip FC250H and Weatherhead H250H hoses that are designed to exceed SAE 100R5 performance levels, but are lighter and more flexible than typical three-braid 100R5 hoses, the company says. The two lines have half the bend radius of 100R5, a 25% tighter bend radius than competitive hoses, and a 15% smaller outer diameter than the 100R5 maximum. Using a universal flat crimp fitting, FC250H and H250H hoses feature a braided cover along with chlorinated polyethylene inner tube. The hoses are available in ISO sizes 4 through 16 (0.19 to 0.88 inch/4.8 to 22.2 millimeter inner diameter).
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www.emerson.com

PRESSURE GAUGE

Ashcroft released its 8009S pressure gauge with removable bayonet ring. The all laser-welded gauge has R110 and NGV 3.1 approvals. It also meets EN837-1 and ASME B40.100 specifications and a MSL Helium leak test of 1x10-6scc/s. Custom dials are available and FlutterGuard comes standard on dry gauges. It also features accessory kits for panel mounting. Available in a variety of connections and ranges, the 8009S is designed for applications including compressed and liquid natural gas, hydrogen cell/hydrogen gas, hydraulic systems, food and beverage, compressors and pumps, irrigation equipment and refrigerant.
www.ashcroft.com

FLOW SENSOR

Endress+Hauser has released its Picomag, a pocket-sized sensor for measuring the flow of electrically conductive fluids, their process temperature and conductivity. Installable into pipe up to 50mm in diameter, the unit offers NPT connectivity and Bluetooth using the company's SmartBlue App. It also comes with on-board IO-Link connectivity and can be ordered with a G thread connection. Various process connection adapters are available, such as R-thread, internal thread, Tri-Clamp or Victaulic. The Picomag attains repeatability of ±0.1% o.f.s. It's suitable for process temperatures between –10 to +85 °C (14 to 185 °F) as well as for process pressures up to 16 bar (232 psi). It requires no inlet and outlet runs and thus can be mounted directly before or after a pipe bend. Its display shows flow, temperature, conductivity and totalizer values, as well as operation errors via NAMUR diagnostic symbols.
www.ca.endress.com

MOTION CONTROL

SERVO MOTOR

Kollmorgen has launched its AKMA servo motor built for medium- to heavy-washdown applications. The motor employs a hardened anodized aluminum surface that offers strong resistance to chemicals across a wide pH range. It is also more scratch resistant and will not flake like a painted motor, making it suited for use above the food line. The AKMA carries a IP69k for wet and rugged environments. Its stainless steel shaft meets functional safety requirements, while its "one-piece" rounded housing structure eliminates the need for a seal between the flange and housing to prevent puddling and water ingress. The AKMA motor also features a vented design to equalize pressure inside and outside for increased OEE and motor durability.
www.kollmorgen.com

DC SERVO ACTUATORS

Moticont released its SDLM-025-095-01-01M and SDLM-025-095-01-01, two linear DC servo actuators that feature high repeatability, high acceleration/deceleration and zero cogging, the company says. The actuators feature internally mounted linear encoders and temperature sensors. The fully enclosed actuators are 25.4mm (1.000 inch) in diameter, the housing is 95.3mm (3.750 inch) long and the total length of the housings and shafts are 139.7mm (5.500 inch). The 3.2mm (0.125 inch) non-rotating shafts have M2.2X0.45 x 5.1 min DP or 2-56 UNC-28 x 0.20 min DP threaded holes, for direct, zero backlash connections to a load at either end. The shafts are supported at both ends by plain linear bearings and can tolerate side loads up to 2.0N (7.2 oz).
www.moticont.com

GONIOMETER STAGE

Optimal Engineering Systems (OES) has added four goniometers to its catalog of positioning stages. The line features worm gears with a 400:1 ratio and pre-loaded cross roller guides that offer +/- 30 degrees of travel with 30 kg of load. The series also offers four motor options. The -01 option (pictured) incorporates a stepper motor,

while the -02 option features a three phase-servo motor with a quadrature optical encoder. The -03 version offers a DC servo motor with a quadrature optical encoder, and the -04 option is stepper motor driven with quadrature optical encoders. The stage series offers a 160mm x 160mm table. The center of rotation is 136mm above the surface of the table and the radius of rotation is 203mm.
www.oesincorp.com

MINI PCI EXPRESS BOARD

Moxa introduced its CP-102N Mini PCI Express, a multiport serial board intended for customized expansion of industrial automation systems. The CP-102N is compatible with any Mini PCI Express slot, the company says, and requires a 3.3 VDC power supply, allowing it to work with host computers ranging from DIN-rail PCs to standard-sized PCs. It includes isolated and non-Isolated RS-232/422/485 communication cards, along with 16C950 compatible UARTs. The board supports Windows and Linux and features four RS-232 serial ports with baudrates up to 921.6 kbps. It also provides full modem control signals to ensure compatibility with various serial peripherals, plus it offers 1 kV line-to-line surge protection and 2.5 kV isolation. The CP-102N can operate in the -40 to 85˚C temperature range.
www.moxa.com

POWER TRANSMISSION

HYGIENIC LINEAR GUIDE

igus has developed a hygienic version of its drylin W linear carriage constructed from FDA-compliant materials, including iglide A160 polymer and high-alloy 316 stainless steel. The guide's gap-free design features a self-draining carriage and rail, hygienic screws and large grooves to prevent water from accumulating. Its beveled edges allow cleaning solutions to run off easily. The bottom seal protects the space under the rail from dirt accumulation and its shafts are sealed to prevent any gaps from collecting debris.
www.igus.ca

TORQUE MEASURING SYSTEM

KTR Systems introduced its MONITEX BT system, a coupling measuring device that continuously monitors torque and speed and transmits the data to a connected LED display or via Bluetooth. With the same footprint as the company's ROTEX-GS coupling, the MONITEX BT system allows it to be incorporated into an existing machine. Featuring inductive contactless energy transmission, the system's sensor box is installed near the OD of the coupling. Measured data is sent via Bluetooth and is saved by a smart mobile device or a PC via the MONITEX app and displayed as curve progression or numerical values. Additionally, minimum, maximum, and average values are continuously calculated. An audio and visual alert will inform the user when max. and min. values are reached.
www.ktr.com

POWER SUPPLY MODULE

Emerson has launched its SolaHD Communication Module (SCM) that provides network connectivity to the company's SDN-D DC

power supply. Connected to an SDN-D, the module allows for continuous diagnostic monitoring over standard Ethernet/IP or HART 7 protocols and transmit this data to supervisory systems. Diagnostic information can also be sent to a historian for predictive maintenance. The DIN-rail mounted SCM provides network connectivity support for one or two SDN-D Series power supplies. Like SDN-D power supplies, the SolaHD SCM features international hazardous location certifications including Class I, Div 2; ATEX and IECEx. The SCM comes with two 8-inch I2C connection cables for direct connection to the power supplies.
www.solahd.com

AUTOMATION

I/O-LINK CONVERTERS

WAGO introduced a line of IP67-rated I/O-Link

analog converters designed for incorporating conventional analog sensors and actuators with IO-Link communications. The 765-2702/200-000 model has two 0-10 VDC inputs that are converted to IO-Link for monitoring field level sensors. The 765-2703/200-000 has two 4-20mA analog outputs while the 765-2704/200-000 has two 0-10VDC analog outputs. Both devices will convert IO-Link signals to analog outputs and all of these devices can be set up using IO-Link configuration tools such as WAGO's IO-Link configurator software.
www.wago.us

WIRELESS HMI

Exor has released its Exor X5 Wireless HMI, featuring a 5-inch color display and dual-band Wi-Fi that allows operators to access and control their machines from anywhere on the production floor. The device also includes a built-in web server and real-time data acquisition and visualization. It also offers customizable alarms and notifications and compatibility with a range of industrial protocols. Other features include a Linux-based OS, two Ethernet ports, Corvina Cloud compatibility and support for JMobile protocols including OPC UA server and client.
www.electromate.com

SYSTEM RECORDER MODULE

Mitsubishi Electric Automation announced its iQ-R Series System Recorder Module,

which helps programmers determine the root cause of machine malfunctions. The module helps diagnose issues by recording all changes in programming code for several minutes before and after an event takes place. Users can review the changes that took place in their code leading up to and after the event. In addition, the system recorder allows users to record the data visually, in video format, directly to the module to note environmental conditions that the code cannot see. Users can resolve machine errors with the iQ-R Series module by having a wholistic view of events as both recorded code and visual play-back.
https://us.mitsubishielectric.com

SENSORS

PHOTOELECTRIC SENSORS

IDEC Corporation introduced its SA2E general-purpose photoelectric (PE) sensor family that includes five major models. The line features a new ASIC that provides improve response times to 0.5ms, compared with 1.0ms for previous generation models. Depending on the model, sensing distances can range up to 20m for through-beam, up to 5m for retro-reflective, and between 10mm and 1000mm for other reflective models. Sensors are switchable between "light-on" and "dark-on" operating modes, and applicable models have an on-board sensitivity or range adjustment potentiometer. The devices consume between 20mA to 35mA, at supply voltages of 12VDC to 24VDC, with the ability to switch up to 100mA maximum. The line is built to operate in a range of -30° to +55°C.
https://lp.idec.com

SHUTTERLESS CAMERA

Teledyne DALSA announced a shutterless version of its MicroCalibir Long Wave Infrared (LWIR) compact camera platform. Developed and manufactured in Canada, the platform integrates the company's 12 µm microbolometer pixel technology with a deep-ADC ROIC circuit, resulting in a

1000°C intra-scene temperature range at a sub-40mK NETD. The shutterless version measures 21mm x 21mm x 12.9mm with lens mount and electronics boards, and weighs 10 grams. The MicroCalibir is supplied without a housing and with an M18 interface (for QVGA video format) or M24 in VGA format. The shutterless MicroCalibir comes with an up-to-date version of the chip-on-board package and provides dedicated image correction.
www.teledynedalsa.com

SOLENOIDS

Magnetic Sensor Systems (MSS) has released its S-66-100 Series, 18 low-profile push/pull clapper solenoids with the ampere turns (windings) adjusted to meet the specific force and duty cycle requirements of an application. The series are 1.00 inch in diameter and 0.66 inch deep. These solenoids have a 0.40-inch stroke and can be operated at a variety of duty cycles (voltage dependent). Supplied with 4-inch leads, mounting is via two 4-40 UNC or M3 x 0.5 threaded studs 0.25 inches long on a 0.656 inch in bolt circle. The pull end of the shaft features a 6-32 thread, 0.50-inch long. The push end is 0.125 inch in diameter. Ideal for short strokes, pull force versus stroke is between 0.10 inch and zero stroke range from 75 oz to 190 oz at 10% duty cycle and from 8 oz to 118 oz at 100% duty cycle.
www.magneticsensor systems.com

PHOTOELECTRIC SENSORS

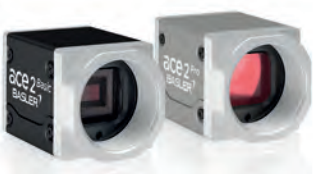
AutomationDirect has added the ProSense F18 series 18mm round photoelectric sensors. The series features sensing distances up to 25m, PBT thermoplastic housings and an IP67 protection rating. These general-purpose sensors are available in diffuse, diffuse with adjustable background suppression, polarized retro-reflective and through-beam sensing styles. The ProSense F18 series photoelectric sensors are UL listed, CE marked and RoHS compliant.
www.automationdirect.com

LEVEL SWITCHES

AutomationDirect has added Endress+Hauser Nivector FTI26 and Liquipoint FTW23 series point level capacitance switches. The Nivector FTI26 series, available in polycarbonate or stainless-steel housings, detects powders or fine-grained bulk solids in silos, hoppers and bins. Stainless-steel versions are FDA compliant and marked with the 3-A symbol for food industry hygienic applications. Select models are CSA approved for hazardous locations. The Liquipoint FTW23 series detects water-based liquids in storage tanks, mixing vessels and pipes. The switches are FDA compliant and marked with the 3-A symbol for food and beverage industry hygienic applications (except versions with G1/2 threads). Both series offer IO-Link compatible models.
www.automationdirect.com

DC ACCELEROMETERS

Silicon Designs has announced a series of enhanced design features for its Model 2220 Series. The series includes the company's Model 1522 surface mount accelerometer as primary sense element, along with an enhanced 1-inch square anodized aluminum case and extended integral cable length to 10 feet. Offered in ranges of ±2 to ±400g, the single axis, low-noise 2220 series features a four-wire connection, with low-impedance outputs that can drive 300 meters of cable. They measure 1-inch square and weighs 10 grams. The accelerometers are +8 to +32 VDC powered and offer both a buffered ±4V differential output and a 0.5V to 4.5V single ended output. Each aluminum case is potted and then epoxy sealed, allowing for ease of accelerometer mounting via two screws, adhesive, or magnets.
www.silicondesigns.com



18 MEGAPIXEL SENSOR

Basler announced the latest addition to its ace 2 Pro product line, which features Gpixel's GMAX2518 CMOS global shutter sensor. With 18 megapixel resolution (4508 x 4096 pixels) and a pixel size of 2.5 µm x 2.5 µm in a 1-inch sensor format, the ace 2 Pro model is paired with Basler's C11 lenses. Like the company's 5- and 9-megapixel ace 2 Pro models, the 18 MP units are available with USB 3.0 and GigE interfaces in both mono and color versions. The company also offers matched vision products, such as vTools – image processing functions within the pylon Camera Software Suite – tested to work with the ace 2 Pro product line.
www.baslerweb.com

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