BREAKING THE MOLD

Generative design approaching the tipping point in automotive part design
Discover the design flexibility of online configuration. MISUMI offers multidimensional configurations for millions of products, equating to 80 Sextillion mechanical part configurations!

Configuring components is easy and saves you time. Design the part, get a quote, or make a purchase, all from the convenience of our website. Critical dimensions such as length and diameter can be selected to design specifications.

MISUMI.INFO/Canada
INSIDE

10 Breaking the Mold
Generative design approaching the tipping point in automotive part design

13 Hot Off the Press
3D scanning and reverse engineering provide the missing link in hot stamping rework

16 The Automation X-Factor
Winnipeg’s Micro Tool & Machine harnesses PC-based automation to boost performance of transformer core production machine

Columns

6 Design News
Engineering dominates list of top earning university degrees and other engineering news

19 Idea Generator
The latest in industrial products including motion control, fluid power and sensors

For Motion Feedback in Industrial Automation,
EPC has your solution.

Call us today to get started.

1-800-366-5412 | encoder.com Standard lead time: still only 4-6 days
A V6-Shaped Recovery

Unlike most industries heavily affected by the COVID pandemic, the automotive sector is experiencing the ‘V-shaped’ recovery in Canada that many had hoped for the general economy, early in the shutdown. While auto sales took a precipitous drop late in the first quarter of the year and fell to its lowest point in the Spring, the third quarter showed signs of it roaring back to life.

According to numbers recently published by Canadian industry analyst firm, Desrosiers Automotive Consultants, light auto sales in Canada fell 20% between January and the end of March compared to the same quarter 2019; plunged by 44.5% year over year in Q2 but was off only 3.2% in Q3.

Overall, in fact, automakers inched slightly higher in sales (2.4%) for September 2020 while some experienced considerable gains during the third quarter. Among the Big Three automakers, only Ford posted a positive gain of 8.5% versus Q3 2019 while foreign brands saw healthier gains. Among them were Kia, with a sales increase of 14.7%, Subaru and Volvo both up just shy of 20% and Porsche up 22% over the same quarter 2019.

As encouraging as that sounds, the above doesn’t include Tesla Motors’ stellar year. Despite the pandemic shutting the doors on its single U.S. manufacturing facility for two months, the electric vehicle company delivered a better-than-expected 139,000 SUVs and sedans in the third quarter. In addition, global sales jumped by 44% and Tesla’s share price has spiked by 400% in 2020. If its claims about the company’s recently announced 4680 battery cells holds true (i.e. a 56% improvement in cost per kWh), the company’s future cars could well be cheap enough to tip the balance of gas vs electric vehicles on the road in the coming decade.

The above numbers signal an upbeat future for Canadian auto parts suppliers, especially when paired with the new sourcing rules implemented by the USMCA agreement which came into effect on July 1 this year. Initiating the first increase in local content requirements since NAFTA came into force, the trade deal is expected to drive significant new demand for Canadian auto parts.

On the automotive assembly side, things currently don’t look as rosy in Canada, but Ford Motor’s decision to transform its Oakville plant into an EV and battery assembly facility could well mark a historic turning point. Investing in new internal combustion assembly here may be a hard sell, but the rise of electric vehicles could well provide Canada’s assembly sector with a whole new story to tell.

MIKE MCLEOD
Editor
mmcleod@design-engineering.com
FEATURING NEW! GS20 DRIVES
The GS20X for your messiest environments.

GS20 and GS20X General Purpose AC Drives
Starting at $135.00 (GS21-20P2)
The GS20 and GS20X drives take the best features of our popular GS2 series drives, add Sensorless Vector and Field Oriented Control, expanded built-in I/O, and include an integrated PLC with optional Ethernet communications. If that isn’t enough, the GS20X models come with a NEMA 4X enclosure so you can install them in a wash-down location. You’ll have a hard time believing that a drive this feature-rich costs as little as it does!

Research, price, buy at:
www.automationdirect.com/GS20

• Broad size offering from 1/4 to 30 hp (GS20)
• NEMA 4X models available up to 10 hp (GS20X)
• Input voltages available: 120VAC, 230VAC, 460VAC and 575VAC
• Built-in PLC supports up to 2K steps
• Built-in USB port for fast & easy programming
• 100kA Short Circuit Current Rating
• Built-in Dynamic Braking – optional resistors
• PID Controller – including sleep and wake
• GS2 mode duplicates exact parameter configuration of existing GS2 drives (GS20 only)
• Two year replacement warranty
• UL/CE listed

GS20X STARTING AT $216.00 (GS21X-20P5)

GS20 STARTING AT $135.00 (GS21-20P2)

Orders over $49 get FAST FREE SHIPPING
Our shipping policies make it easier than ever to order direct from the U.S.!

Fast free standard shipping* is available for most orders over $49 U.S., and that includes the brokerage fees (when using an AutomationDirect nominated broker). Using our choice of carrier, we can reach most Canadian destinations within 2 to 3 days.

*Free shipping does not apply to items requiring LTL transport, but those shipments can take advantage of our negotiated super-low flat rates (based on weight) that include brokerage fees.

See Web site for details and restrictions at:
www.automationdirect.com/canada

To see all products and prices, visit www.automationdirect.com

All prices shown are U.S. Dollars

Order Today, Ships Fast!
1-800-633-0405
the #1 value in automation
EDUCATION

ENGINEERING DOMINATES LIST OF TOP EARNING UNIVERSITY DEGREES

According to a study by Statistics Canada, students who earn an engineering degree make substantially more than their counterparts with degrees in other fields. Out the top 10 most lucrative degrees, 6 of them are in various engineering disciplines for men and 7 for women.

For male grads, mining and mineral engineering took the top spot; five years after graduation, these degree holders received median earnings of $111,533, adjusted for age, institution and graduation cohort, the study found. Rounding out the top five were pharmacy and pharmaceutical sciences, followed by petroleum, nuclear and chemical engineering.

For women graduates, pharmaceutical sciences ranked first, with adjusted median earnings of $94,177 five years after graduation followed by four engineering degrees: Mining, chemical, mechanical and industrial.

In total, 23 different engineering disciplines ranked in the top 44 of the 118 disciplines studied for male graduates. For female graduates, only nine engineering disciplines appeared on the list, due to smaller samples Statcan says, but they were all in the top 15 based on median earnings.

In comparison, both men and women graduates with arts or humanities degrees fared far worse financially. Median earnings ranged from $42,298 to $35,935 for men and $33,765 to $19,892 for women. Overall, median earnings of arts and humanities graduates were well below that of all bachelor’s degree graduates.

The study is based on students who graduated between 2010 and 2012 and their median earnings five years later, including those who reported zero earnings.

www.statcan.gc.ca

UWINDSOR RESEARCHERS SCORE FUNDING TO DESIGN NEXT-GEN EV MOTOR

Research engineers at the University of Windsor have received $1.9 million from NSERC to develop lightweight, compact, aluminum-intensive induction motors for electric vehicles. The public funding is in addition to $2.4 million from Ford Motor Company of Canada, D&V Electronics and Nemak for nearly $4.3 million in total.

Lead researcher, Narayan Kar, says that to increase range and performance, electric vehicles will require motors that are high-performing, compact, lighter, cost-effective and easy to manufacture.

“This collaboration aims to directly address these needs by developing lightweight, multi-material, and high-efficient traction motors with improved thermal and structural integrity,” says Kar, who leads UWindsor’s Centre for Hybrid Automotive Research and Green Energy.

For its part of the project, Nemak will cast the motor components UWindsor develops from its proprietary electrically conductive aluminum alloy while D&V Electronics will apply its testing technologies to assess the new motors.

Six UWindsor researchers will contribute to the project, including Xueyuan Nie, Henry Hu, and Ofelia Jianu from the Department of Mechanical, Automotive and Materials Engineering; Mehrdad Saif from the Department of Electrical and Computer Engineering; Nick Vukotic from the Department of Chemistry and Biochemistry; and Ziad Kobti, director of the School of Computer Science.

The project is funded through the number of engineering disciplines in the top 44 of the most lucrative University degrees in Canada.

Researchers in UWindsor’s Centre for Hybrid Automotive Research and Green Energy working on a state-of-the-art EV electric motor test system that will be used to conduct next-gen electric vehicle research.
an NSERC Alliance Grant, which encourages university researchers to collaborate with private, public or not-for-profit sector organizations.

http://chargelabs.ca
www.nemak.com
www.dvelectronics.com

**MCGILL RESEARCHERS’ COLD-SPRAY COATING DEACTIVATES COVID-19 VIRUS**

A research team at McGill University announced it has been awarded an NSERC Alliance COVID-19 grant to further develop an antiviral coating. Composed of copper alloys, the team says its cold-spray coating is highly effective at deactivating the COVID-19 virus, as well as bacteria, on high-touch metallic surfaces.

“Our initial trial data, obtained in collaboration with the National Research Council of Canada, demonstrates the efficiency of the coating in deactivating 99.9 per cent of human coronavirus in 30 minutes,” said Stephen Yue, a James McGill Professor in the Faculty of Engineering.

“There is an entire value chain in Canada around cold spray technology, which can be rapidly activated and deployed to help reduce the spread of SARS-CoV-2 in public spaces, such as hospitals and public transit and which will benefit tremendously from this research.”

As part of the project, the McGill and NRC researchers will develop and test its antiviral coatings at the McGill-NRC cold spray facility. The team will also partner with Polycontrols, Hatch and 5N Plus. The industry partners will provide expertise in the preparation of the powder feedstock materials and developing the manufacturing process that will be carried out at the NRC’s and Polycontrols’ joint facility, PolyCSAM.

**ATS LANDS $20M VACCINE SYRINGE MANUFACTURING LINE ORDER**

ATS Automation Tooling Systems Inc. announced it has received a $20 million order from a medical device manufacturer to design, build and deliver several automated safety syringe manufacturing systems that will feature the company’s new Symphoni digital manufacturing technology. The program will be completed over the next 10 months and will enable the production of safety syringes to meet potential demand related to COVID-19 vaccine production.

According to ATS, its patented Symphoni technology is characterized by a high degree of standardization, modular building blocks and a plug-and-play nature. Because a Symphoni system is digital and 100% programmable, all movements are precisely mapped out and synchronized through a technique known as electronic gearing. As such, it assembles high-volume consumables such as syringes at high rates while assuring compliance to the medical device industry’s rigid quality standards.

The vaccine syringe contract is related to the US Government’s Operation Warp Speed which seeks to increase production of safety needles and syringes to meet anticipated demand.

https://atsautomation.com

**KRAKEN ROBOTICS LANDS NRC FUNDING TO DEVELOP NEXT GEN AUV**

Kraken Robotics Inc. announced it will receive a $2,909,891 non-refundable financial contribution from the NRC’s Industrial Research Assistance Program to support the development of the company’s ThunderFish XL Autonomous Underwater Vehicle (AUV).

Based on its ThunderFish Alpha AUV, the larger XL version will have an increased depth rating, a larger payload capacity and have longer mission endurance. In addition, the ThunderFish XL will be able to transition from high-speed survey mode to “zero” speed hovering mode. In addition, the XL will have through-the-sensor acoustic, laser and optical target detection; image recognition and inspection; and the ability to use on-board sensors to improve vehicle navigational accuracy.

Depth rated to 6,000 metres, the ThunderFish XL will carry an array of sensors and custom payload modules, including the company’s AquaPix Synthetic Aperture Sonar, SeaVision 3D laser profiler, SeaThrust rim-driven thrusters.
Wear-Free Angle Measurement

RFC 4800 Series of touchless sensors use a magnet attached to your application’s rotating shaft. Now with IO-Link output option, these sensors can be easily connected with a 3-wire version. Voltage, current and other digital output options provide design flexibility. They keep measuring even during a loss of power, reporting the correct position when it is restored.

Key specifications:
- Repeatability to 0.1°
- Resolution to 14-bit
- Linearity ≤ ±0.5% of F.S.
- 2-ch. version option
- Speed output option

Free touchless angle sensors primer: www.novotechnik.com/rfc48

Email: info@novotechnik.com

and SeaPower pressure-tolerant batteries. In addition, Kraken says it will design an autonomous underwater docking station allowing the XL to function as a seabed-resident AUV. https://krakenrobotics.com

BALLARD LAUNCHES HIGH-POWER DENSITY FUEL CELL STACK FOR VEHICLE PROPULSION

Ballard Power Systems launched its FCgen-HPS proton exchange membrane (PEM) fuel cell stack, designed to provide propulsion for light-, medium- and heavy-duty vehicles. The fuel cell boasts a power density of 4.3 kilowatts per liter (4.3 kW/L), 140kW of power output and an operating temperature range from 95°C down to -28°C.

Ballard designed and developed the FCgen-HPS to the automotive standards set by the company’s Technology Solutions program with Audi AG. The Vancouver-based company holds the right to use the FCgen-HPS for a variety of applications, including bus, rail, marine, mining, construction and aerospace vehicles, along with stationary power applications.

In addition, Ballard has signed a Memorandum of Understanding with AUDI to expand its right to use the fuel cell in all applications, including commercial trucks and passenger cars.

www.ballard.com

EMERGING TECHNOLOGIES UNDER-INVESTED IN BY CANADIAN COMPANIES

According to a report by KPMG industry analyst firm HFS Research, seven out of 10 Canadian technology executives say that emerging technologies are essential to their organization’s future survival.

However, the company’s Enterprise reboot report also found those Canadian firms are investing in disruptive technologies (e.g. 5G, AI, blockchain, edge computing, cloud, process automation and smart analytics) to a lesser degree than their U.S. peers. U.S. companies currently spend on average US$17 million per technology – 30 per cent more than what Canadians spend.

“We’re starting to see a sea-change in how the C-suite views technology because of the COVID-19 pandemic, with over four in five Canadian CEOs now prioritizing technology investments,” says Stephanie Terrill, business unit leader, management consulting, KPMG in Canada. “Canadian CEOs recognize they need to make the right investments to help build resilience and emerge stronger from this crisis.”

KPMG’s recent Global CEO Outlook found that 84 per cent of Canadian CEOs are now prioritizing their technology investments to meet growth and transformation objectives; the vast majority (92 per cent) say COVID-19 has accelerated the digitization of their operations.

The Enterprise reboot report notes that CTOs in Canada say that the main barriers for investing in emerging technologies are fear the technology won’t work; challenges in changing the organizational culture; and the lack of talent or skillset in implementing the technology to achieve business outcomes.

https://home.kpmg/ca

Visit design-engineering.com for the latest new products, news and industry events.
Designing efficient systems involves much more than simply understanding a few basic principles. There is a true art to balancing the specific requirements of an application in order to achieve the desired goals in the best possible way. Help us understand the unique needs of your application and together, we’ll develop something that surpasses what any of us could have done alone.

Contact your distributor to learn more, or visit clippard.com to request a free catalog and capabilities brochure.
Traditional engineering and design techniques are rapidly being augmented with generative design, nowhere more visibly than the automotive sector. Generative tools may have started out in the rarefied atmosphere of F1 motor racing, but there is increasing interest and use of the tools and techniques involved throughout the motor industry. Generative design is one of the hot topics in automotive design at the moment, due to a perfect storm of contributing factors.

So what is it, and why is it important? Generative design is an iterative process that explores a much wider range of solutions in a collapsed timeframe than a traditional design and engineering process. Designers or engineers input design goals into an AI tool, which then explores all the possible avenues for a solution. Design goals might include requirements such as strength, weight and force tolerances, instead of preconceived ideas about what a part should look like.

The generative design tool tests and learns from each iteration, gradually optimizing the component or part in question, but at a far faster rate than a traditional process – especially in the automotive industry, where clay modeling and manual sculpting have played a starring role for decades. The overall result is a faster, cheaper and in many ways more innovative process that can transform the look, feel, performance and cost of a component.

That might sound optimistic, but the market is on an upward trend, with a recent analyst report predicting that the global generative design market will grow from US$111 million in 2018 to US$275 million by 2023, at a CAGR of 19.9 per cent during that period. The report, from ResearchandMarkets.com, ascribes much of the momentum to the automotive market, due to the drive for cost and production efficiency, as well as the ability to test and analyze designs of products in a virtual environment.

Driving Democratization
While these attributes were initially developed in the specialized atmosphere of F1 racing, the trickle down has been enormous, in part due to the rapid democratization of the basic tools needed for the job. Powerful desktop PCs, easy access to almost limitless cloud arrays of processors, and Software as a Service (SaaS) AI offerings have leveled the playing field considerably.

That said, even with the best tools and a significant amount of capital, the most innovative designers still need good baseline data to feed their models – something those F1 teams have elevated to both a science and an art. One example from Japanese auto-maker Honda was a collaboration with Autodesk to redesign and 3D print a crankshaft component to make it lighter and more fuel-efficient. The initial aim was to design a crankshaft to be 30 per cent lighter than current models – a challenging brief. The updated crankshaft had an organic structure unlike its conventional counterpart and reduced weight by an astonishing 50 per cent.

Meanwhile, at GM, engineers set out to generatively design a new but highly optimized seat bracket, a standard car part that securely links seat-belts to seats and seats to floors. That may not sound particularly challenging, but the existing seat bracket consisted of eight parts that required welding together, a time-consuming and cost-increasing process. The final design was one single piece of stainless steel that is 40 per cent lighter and 20 per cent stronger than the previous seat bracket.

In the EV market, generative design will play a central role.
**Less Weight = Better EVs**

Saving weight might seem most relevant to racing teams striving for that fraction of a second advantage, but it is increasingly becoming a core requirement in consumer vehicles. The drive to lower roadside emissions is increasing, with a 2019 level of 130g/km of CO₂ emissions cut to 95g/km in 2020, and set for further restriction in the near future. Lighter components offer a means to cut emissions of fossil fuel vehicles, but also have an impact in the EV market.

In the electric vehicle sector, though, generative design will play a central role, especially given the higher appeal and greater appetite for organic, unusual designs in a maturing market (as opposed to the arguably more traditional car industry). An interesting example here is EV firm Arcimoto Inc, which is working with XponentialWorks and ParaMatters to develop lightweight components for its Fun Utility Vehicle (FUV).

The aim is to reduce weight but maintain strength in key components in order to increase the vehicle’s range and improve acceleration and handling. To date, the rear swing arm has lost 34 per cent of its weight, the brake pedal has slimmed down by up to 49 per cent, and the upper control arm has lost up to 52 per cent.

**Generative Tipping Point**

The potential weight savings touted by the generative designers are compelling, but not all...
projects are a success, especially as the results often rely on 3D printing to generate them. 3D printing is still ideal for low production runs of high-end components, or for fast prototyping, but is less cost-effective for mass production.

In addition, not all organic generative designs are an immediate public success, such as VW’s innovative but unusual-looking VW Microbus concept fitted with generatively designed bright orange wheels. That said, the wheel design prompted much debate and column inches of media coverage, and also generated an 18 per cent weight saving – both metrics of considerable interest to VW, at least.

Generative design appears to be approaching something of a tipping point – there are many strong examples of good results in use, but there are inhibiting factors preventing mass adoption, especially cost. However, the cost per unit of 3D printed items is falling rapidly, and the potential to decentralize production is not to be lightly dismissed. In short, generative design is here to stay – but maybe not in the shape we expect.

Martin Keenan is the technical director at Avnet Abacus, which assists and informs design engineers in the latest technological challenges, including developments in the electric powertrain and automotive Ethernet.

GM engineers used generative design to produce a proof-of-concept seat bracket that consolidates eight different components into one 3D-printed part that is 40 percent lighter and 20 percent stronger than the original part.

Photo credit: General Motors
HOT OFF THE PRESS
3D scanning and reverse engineering provide the missing link in hot stamping rework.

The automotive sector relies on a multitude of manufacturing industries. Hot stamping (i.e., hot forming or press hardening) is one of the most common processes in the race towards safer and lighter cars.

It can be described as the process of transforming thin, low-tensile-strength metal into high-strength steel through heat using a press and die set. By performing the stamping while the steel is nearly molten, the process eliminates springback and allows for the manufacture of complex geometries.

Gestamp is an international group dedicated to the design, development and manufacture of metal automotive component. They produce chassis, mechanism and body-in-white parts for the main auto manufacturers. Regarding their hot stamping output, among other things, they build bumper beam, crash box and door ring components.

When it comes to die replacement or manufacturing, hot stamping companies like Gestamp undergo the same struggles: They have to rely on early die drawings that may or may not be up to date.

Why is it a problem to rely on the original drawings? There are many people working on the implementation of stamping lines, and since the process bottleneck often resides at the design phase, the adjustments made between the CAD model of a die and the actual die used in production are now and again not recorded or documented.

Without this information, how can the die replacement process be managed efficiently? What would be a sound alternative to this process? What is the cost and timetable for the implementation of a substitute solution? The good news is that 3D scanning systems and reverse engineering are game changers in industries where quality and purpose are based on meticulous precision.

A Classic Approach
Just like most design-to-production workflows in manufacturing environments, hot stamping has classic steps that should work seamlessly.

Gestamp’s stamping line development process proceeds through the following steps. The stamping plant receives a CAD file for the new part – a work order of sorts. Engineers then use the model to design the die that will be used to stamp the part and
Gestamp’s hot stamping dies are inevitably tweaked and modified from their initial CAD dimensions on the shop floor – details that can be lost if a die breaks.

saved as a 3D model the die manufacturer will use to make the die.

Once built, the physical die is sent to the stamping plant where it goes through inspection, quality control and fine-tuning.

Following customer approval, the die proceeds to the production environment, where it will be used to produce precise parts, matching the exact specifications.

While this may seem a normal process, for Gestamp, problems occurred after the die was in place and used in the hot stamping process, (i.e. when the die needed to be replaced).

Among other things, the replacement of a die can result from a partial or total breakage, the end of life of the die or a considerable rise in demand which requires the manufacturing of an identical die to meet the increasing needs.

In the absence of an updated CAD model to rely on, the engineers had to use the initial design of the die to produce a new one. This ended up being a time-consuming, costly and frustrating mistake. Using the older drawings inevitably resulted in material waste, negative impacts and parts that are out of specifications.

Since the former die is either broken or unusable by now, it is necessary to go through the whole cycle again: The initial CAD file is sent to the manufacturer, who returns the die for fine-tuning before production can start up again. The main issue has to do with the adjustment data not being accounted for at some point in the process. This can result from several causes, although two stand out.

For new stamping lines and processes, the engineers who perform the inspection, QC and fine-tuning steps work under extreme pressure and sometimes fail to effectively collect and document all modifications made during the development phase.

The modifications are collected, documented and transmitted to the engineering department, but the engineers fail to update the original drawings due to a lack of resources.
3D Scanning to the Rescue

Without a doubt, the missing link in the chain is the clear communication of updated features to the engineering department. Since even the most robust workflows are exposed to human error, the situation calls for a streamlined process enhanced by the right tools for the job.

Technical managers of stamping operations at Gestamp decided to turn things around and pursue new avenues such as 3D scanning. They added several steps to the traditional process. Once the die is adjusted and producing parts within specifications, it is then scanned which captures all the modifications made, including its slightest details. The output mesh file, which corresponds to the scanned die surface, is then incorporated into the initial 3D model of the die. In the future, it can be used to reverse engineer the die.

For Gestamp managers, the benefits are obvious: The high-precision and portability of 3D scanners such as the HandySCAN 3D, and the availability of increasingly sophisticated reverse engineering software aimed at the process of transforming scanned surfaces into data.

Therefore, when a die is already adjusted to the specifications and actively producing parts, it can be scanned right on the shop floor to record and crystallize the modifications made to the former die. Instantly, an updated CAD can be made available.

Bottom line, with the inherent accuracy of Creaform’s solution, the adjustment phase of the new dies manufactured for Gestamp is considerably shorter, if not completely removed. [DE]

www.gestamp.com
www.creaform3d.com

Article provided by Creaform
Based in Winnipeg, Manitoba, Micro Tool & Machine Ltd. (MTM) provides machine solutions for the manufacture and distribution of medium-size power transformers, along with aerospace, medical and other industries. The company designs and manufactures complete systems that integrate CNC, robotics, tooling, assembly, jigs and fixtures.

Since its founding in 1964, the company has offered high degrees of customization to accommodate the unique process flows or facility layouts of its global customers. The engineering team often reevaluates technologies and components to provide the most robust capabilities, as was the case in the recent redesign of the company’s X-Shear machine.

To guide that redesign, MTM made repeatability its top priority while working to increase throughput of its X-Shear machine; in transformer core manufacturing, efficiency gains in production cannot sacrifice part accuracy.

“Higher production rates are the goal of every machine manufacturer,” says MTM general manager, Gord Atamanchuk. “Doing this without sacrificing processed part accuracy is critical to our success. Once processed, being able to assemble those parts into the final e-stacked core, while minimizing gaps, is more critical than ever due to the industry trends to reduce post-processing time downstream.”

The redesigned XS600-P20E X-Shear machine cuts, stacks and assembles transformer laminations using PC-based automation and robotics. At one end, it uses an X-shaped blade configuration to cut any required geometry from coiled lamination of varying widths. After that, two articulated KUKA robots – in conjunction with two pick and place arms – assemble the core pieces.

The system is designed to cut and assemble up to four transformer cores at once in e-stacking modes and sort the cut laminations into 30 segment piles when not in e-stacking modes. However, it can scale up or down depending on product sizes, according to Eduard Streichert, Electrical Lead at MTM.

“Using what we learned from previous machines, we made several upgrades for this new X-Shear,” he says. “The biggest upgrade was the conversion to the Beckhoff control system.”

Multitasking Challenges

At 13 meters long by 8 meters wide, the X-Shear’s footprint already measured up to three times smaller than many competitors, according to Atamanchuk.

“Our integrated method for loading and unloading reduces the size of the machine,” he says. “Most other machines stack segment piles in a linear fashion, while we use a space-saving grid format.”
For the redesign, MTM engineers focused on optimizing throughput, increasing cut accuracy and reducing component and labor costs. They also wanted to reduce wiring with distributed I/O modules. The X-Shear needed to leverage IoT-ready technologies to provide opportunities to further enhance machine performance and enable remote support, since the machine would eventually be installed in China. It also needed to shorten PLC cycles and scan times.

“One of the biggest keys was implementing a true multitasking controller,” Streichert explains. “The previous control platform we used fell short of our runtime requirements. The system had limited capability to perform conditions or commands in parallel. This meant fewer parts per minute. Switching to a standardized PLC program – specifically IEC 61131-3 – would provide further gains. For electrical technicians, it’s easier to troubleshoot in standard PLC languages.”

MTM engineers combined what they had learned from previous systems and customer feedback to implement a new control platform for the X-Shear. In the five years leading up to this re-design, the engineering team had transitioned all other machines to PC-based control from Beckhoff Automation. Now, they were ready to update the largest and most complex machine.

**The XS600-P20E X-Shear features two articulated KUKA robots to stack the cut laminations.**

**PC-based Automation**

MTM found the multitasking control system needed to enhance the X-Shear in TwinCAT 3 automation software and the Beckhoff’s C6930 control cabinet Industrial PC (IPC). The multiple runtimes in TwinCAT enable deterministic control for parallel tasks, including high-velocity coordinated motion used with the X-shaped cutters.

Through Visual Studio integration, TwinCAT enables programmers to use the best language for the project and the engineer, including IEC 61131-3 and its programming standards, object-oriented extensions and predefined or custom function blocks.

“Unlike the previous programming platform, TwinCAT helps technicians see potential issues faster and understand how to fix them,” Streichert says. The C6930 control cabinet IPC boasts a seventh-generation Intel Core i5 processor with four cores and a 2.7-GHz clock speed. The single PC-based controller handles control logic, IoT connectivity and other functionality for the cutting and stacking cells.

“As a true multitasking controller, the C6930 reduces machine cycle times so that throughput is much higher,” Streichert says. “The IPC offers one combined solution for PC and PLC technologies. This includes everything from connecting to higher-level systems and enabling remote support to storing recipes and running the HMI in Visual Basic.”

For operator interface, MTM selected a CP3921 multi-touch control panel with custom push-button extensions. This IP65-rated, 21-inch touchscreen is pole-mounted on the cutting cell. The stacking cell features a built-in CP2912 multi-touch control panel, which provides the same HMI experience scaled to a 12-inch touchscreen.

“Beyond standard machine control, operators can use these touchscreens to enter different core files or for recipe management,” Atamanchuk says. “This was also the first time we used CP-Link 4, which helped reduce cabling requirements.” CP-Link 4—the one cable display link—supplies power, USB 2.0 and DVI signals to control panels in a single cable up to 100 meters from the controller.

**Need for Speed**

For Beckhoff Applications Specialist Chris Timmermans, upgrades in motion control and networking were among the most important aspects in the X-Shear project.

“MTM shifted fully to the Beckhoff platform by implementing AX5000 servo drives and AM8000 servomotors, along with various gearboxes for

---

@design_eng_mag

October 2020  DESIGN ENGINEERING  17
For the automakers that are shifting into high gear and making much needed ventilators.

UNSTOPPABLE
24/7/365

A true multitasking controller, the Beckhoff C6930 control cabinet IPC handles all functions for the cutting and stacking cells.

the cutting axes,” Timmermans says. “The EL7211 EtherCAT terminal for servomotor control also offered a compact motion solution with a high RPM, and its 24-mm-wide, DIN rail-mounted I/O form factor saved space in the electrical cabinet.”

The fully integrated Beckhoff ecosystem enables motion design tools, real-time PLC and a digital oscilloscope all inside the standard TwinCAT software. This helped with fine-tuning movements for highest accuracy, Streichert explains. “When tuning motors on the X-Shear, we use TwinCAT Scope View and really pushed the system to its highest performance.”

EL series EtherCAT terminals comprise the main I/O of the X-Shear’s control cabinet, and IP67-rated EtherCAT box modules distribute intelligence across the machine. TwinSAFE boxes and terminals also offer TÜV-certified functional safety with programming in TwinCAT and communication over the standard network.

Without hardwiring of black-box safety switches, MTM connected all E-stops, light curtains and safety gates on this model. The modular design allows end users to tie in additional safety devices to the system as desired.

“The integrated architecture offered many advantages in terms of both commissioning and performance,” Streichert explains. “Along with CP-Link 4, the EtherCAT and TwinSAFE solutions greatly reduced cabling and wiring effort. The EP boxes allow the controller to capture signals from sensors, along with hydraulic and pneumatic devices, spread throughout the X-Shear. As a result, we increased performance while reducing expenses.”

Optimized Performance
By transitioning to the Beckhoff platform, MTM boosted performance and functionality for the XS600-P20E X-Shear. The machine increased its maximum cutting speed to 34 sheets per minute – a 55% increase in speed compared to previous models with the legacy PLC.

These gains resulted, in part, from a significantly faster PLC cycle time of 1ms. Beyond reducing cabling, control cabinet requirements and costs for the related components, the Beckhoff engineers also helped MTM optimize servomotor sizing, allowing them to scale down and reduce expenses compared to the previous solution while still boosting overall performance.

Most importantly, the X-Shear redesign accomplished its key goal – maintaining high cut accuracy. “All of these improvements are very important and make our machine stand out to customers when compared to others on the market,” Atamanchuk says. “The Beckhoff platform’s scalability will also allow us to make upgrades and increase functionality on the X-Shear and our other machines.”

Since transitioning, MTM has completed nearly 30 projects using PC-based automation. The components have allowed the company to focus on other business and technology aspects, according to Atamanchuk.

“We’ve been able to standardize our HMI layouts to present information more clearly and still insert system-specific pages, and we plan to implement this with TwinCAT HMI very soon,” he says. “With Beckhoff, we have access to IoT-ready components from one manufacturer, making it easier to roll out new features to customers, which was more challenging in the past.”

IDE www.mtmmachines.ca
www.beckhoff.ca

Article provided by Beckhoff Automation

Local site: sewcan.ca
Corporate site: sew-eurodrive.ca
**NEW PRODUCTS**

NEW PRODUCTS

**MULTI-AXIS SERVO SYSTEM**

Beckhoff announced that its AX8000 multi-axis servo system now offers oversampling technology. This feature enables multiple samples of process data within a communication cycle with an oversampling factor of up to 128 and the transfer of all data in an array via EtherCAT. In addition, new setpoint values can transfer every 62.5 μs from the motion controller in the Industrial PC to the servo drive, along with μs motor current scans. Measured variables can be recorded several times in the drive, and the controller can access the buffered values within one cycle. In this way, a chart in TwinCAT Scope View can provide higher resolution, for example. In addition, synchronization with other drives – with or without oversampling functionality – remains unaffected, the company says, due to the distributed clocks principle of the EtherCAT industrial Ethernet system.

**12V PLC**

IDEC Corporation has added three 12V DC 16 I/O CPUs to its MicroSmart FC6A PLC product line, designed to run on 12V DC batteries. Like the other PLCs in the line, the added PLCs feature Ethernet, USB and serial connectivity; a SD memory slot; replaceable battery; HMI module; and up to three I/O expansion modules with removable terminal blocks. The PLC line operates at temperatures between -25 to 65°C and in Class I Div 2 environments. Users can configure and monitor the PLC using the WindEdit app for iOS and Android over Bluetooth and Ethernet. The Modbus TCP and RTU industrial protocols are built-in, as are data logging and web server functions.

**HIGH RESOLUTION CAMERA**

Basler has expanded its ace 2 camera series with 24 models featuring the Sony Pregius S sensors IMX540, IMX541, and IMX542. The sensors offer small pixel size, backside-illuminated structure (BSI) and global shutter. With 16 to 24 megapixels, the ace 2 Basic and ace 2 Pro models maximize the possible resolution in a C-mount format. The IMX540 features a 24 megapixel resolution (5328 x 4608 pixels); the IMX541 has a 20 megapixel resolution (4512 x 4512 pixels) and the IMX542, a 16 megapixel resolution (5320 x 3040 pixels). Depending on resolution and interface (USB 3.0 / GigE), the cameras deliver frame rates of 4 to 23 frames per second. The combination of BSI and Global Shutter ensures recordings without motion artifacts, even at high speeds.

**MOTION CONTROL**

**MOTOR/DRIVE COMBO**

Siemens Industry released motor/drive packages based on a pre-determined list of motor/drive combinations that are packaged, shipped and invoiced together. The combinations are power-matched for 480V high-overload operation through a 20 hp range, with 12T protection from thermal damage provided as a standard in both the motor and the drive components. The Siemens Intelligent Operator Panel (IOP) is included with these packages. Application macros are provided in the Sinamics G120C drive; the terminals are pre-assigned at the factory and the parameters are automatically set. The SIMOTICS SD100 motors are cast-iron with inverter duty ratings in a 4:1 speed range for constant torque and 20:1 speed range for variable torque. Simotics SD100 units are severe-duty TEFC motors that meet NEMA Premium efficiency.

**ELECTRIC ACTUATOR**

SMAC unveiled its LBR40, a slim, stackable linear rotary actuator that incorporates the company’s HT75 direct drive brushless motor. Encoder resolutions are available from 5μm standard, with a 1 and 0.1μm option for most actuators. In addition, the actuator offers a stroke up to 25mm and force up to 500N. The multi-turn servo motor provides torque up to 4.5Nm, velocity up to 5000 rpm and resolution up to 132,000 increments per revolution. The vacuum passage built in the shaft through the rotary motor prevents dust build up in the unit. IP67 protection is available as well as a built-in controller with popular communication protocols.

**WELDING ACTUATORS**

Tolomatic introduced the latest version of its Compact ServoWeld actuators, designed for automotive and sheet-metal welding applications and available in two patent-pending models. The ServoWeld CSWX, for both steel and aluminum weld applications, features a roller nut that handles applications with C, X and pinch...
weld guns. The CSWX provides up to 18kN of pressing force (4,047 lbf) in a 90mm frame. Top-speed C-gun performance is 10.5kN of force (2,023 lbf) and 700 mm/sec (27.5 in/sec). Model CSW is designed for lower force (15.6kN [3500 lbf]) and lower duty cycle applications (20 million+ welds) for C, X and pinch weld guns. Top speed C-gun performance is 7.9kN (1,641 lbf) and 700 mm/sec (27.5 in/sec).

www.tolomatic.com

**AC SERVOMOTORS**

Nippon Pulse America released its micro direct-drive (MDD) AC servomotors series that features a built-in encoder (either absolute or incremental). According to the company, the motors can bear large loads and deliver increased torque. They also feature a ripple-reducing design and are clean-room ready. The motors come in frame sizes from 13mm to 70mm and can support hollow shaft structures. Each frame size is available in three stack lengths. Nippon Pulse offers custom motor shafts and cable lengths, as well as various sealing options.

www.nipпонpulse.com

**MINIATURE GUIDE**

THK released its Type RSX Miniature LM guide that features an optimized circulation structure. The guide is available in a standard Type RSX-M and a Type RSX-WM with a longer overall LM block length, wider width, higher-rated load and permissible moment than the Type RSX-M. The outer dimensions of the Type RSX-M range from 8mm to 16mm (H), 17mm to 32mm (W) and 23.4mm to 42.9mm (L). The outer dimensions of the Type RSX-WM range from 9mm to 16mm (H), 25mm to 60mm (W) and 31mm to 55.5mm (L). Additional features of the LM guide include a built-in retaining wire that prevents balls from falling out and a groove contact structure that receives loads in all four directions.

www.thk.com

**FLUID POWER**

Clippard launched its Cordis HP500 pressure control that incorporates a microcontroller, integrated pressure sensor and two of the company’s EV line of electronic valves. The inlet valve is connected to the moderately regulated supply pressure and the exhaust valve is connected to a port that vents excess pressure to atmosphere. Once a command is increased, the inlet valve opens to allow supply pressure to pass over the sensor element which provides an active feedback for the micro-controller to satisfy the set point in

**PRESSURE REGULATOR**
the process. Features include integrated internal or external sensor feedback as well as customizable mounting options and pressure ranges from 0 to 500 psig. www.clippard.com

SOLENOID VALVES
ODE has launched a line of NSF-certified brass-bodied water valves for food and beverage grade potable water applications.

Two types of these brass solenoid valves are available: Direct acting and pilot control solenoid valves. Both types of valves are 2-port, 2-position, normally closed. Direct acting solenoid valves with G1/8 or G1/4 port sizes are certified NSF/ANSI 169. Maximum operating pressure is 580 psi. Solenoid valves with pilot control are NSF/ANSI/CAN 61 certified for use with water and other compatible fluid applications. A minimum operational pressure of 0.2 bar (2.9 psi) is required. 3/8-, 1/2-, 3/4- and 1-inch NPT port sizes are available. Maximum pressures are 232 – 363 psi. www.automationdirect.com

STEPPER VALVE
Spartan Scientific released its STEP 12, a media-separated electronic proportional flow control valve with more than 1,500 different positions (or steps). The valve is self-contained with control circuitry (including an M12 connector) for both the motor and valve. In addition, control can be tailored to increase resolution. The valve is designed for full flow under maximum pressure conditions. A 1/2-inch NPT version is capable of accommodating 30 GPM of water with a maximum pressure of 150 psi. The valve features an on-board LED (RGB) indicator that displays device status. A separating diaphragm with a convolution and elliptical flow tip produces a linear flow versus valve stroke position. www.spartanscientific.com

ALL SPRINGS ARE NOT EQUAL®

Reduce spring height by 50% over ordinary coil springs while maintaining the same force and deflection. Standard parts available in stainless and carbon steel. Need custom? No problem. We’ll provide you with the right spring, in the right material, for your specific application.

RotoPrecision Inc.
TORONTO | MONTREAL | VANCOUVER
rotoprecision.ca | (888) 712-3400

Call (888) 712-3400 or visit rotoprecision.ca/products/wave_springs
WEBINARS

SENSORS

POSITION SENSORS
POSITAL has launched a line of IXARC encoders with the Modbus RTU interface and use of the RS485 transmission standard, based on shielded twisted pair cabling. This combination offers reliable communication over 1,000 metres, even in the presence of electromagnetic interference. The POSITAL encoders are available in multiple housing materials and levels of environmental protection, shaft type and diameter, mounting flange and connector type. Options include single- and multi-turn measurement ranges. For multi-turn models, the rotation counter is powered by a Wiegand sensor. Modbus support extends to the company’s TILTIX range of inclinometers. www.posital.com

ANGLE SENSORS
Novotechnik U.S. unveiled its SP2800 Auto-Sport Series of rotary sensors for angle measurement. Key specifications include 20 models covering measurement ranges of 0 to 100°, 130°, 308°, 345° or 350°. There is also a redundant version with a 100° range. These ranges were specifically selected for sequential gearbox, steering angle, throttle and suspension measurement applications. Repeatability is ±0.01%. Linearity is to ±0.3% depending on model. The series is hermetically sealed to IP67 and provides a service life of greater than 50 million cycles. They can be ordered with plastic or aluminum housings. Temperature drift is ±5 ppm/K and the parts will operate up to 20g. Operating temperature range -40 to +150°C (−40 to +302°F). www.novotechnik.com

SAFETY SWITCHES
AutomationDirect announced it now offers IDEM non-contact RFID coded safety switches designed to provide interlock protection on hinged, sliding or removable guard doors. When used in combination with a dual channel safety relay or control device, the safety switches can provide protection up to Category 4 and PLe to ISO13849-1. The IDEM KLP-Z, KLM-Z and KL3-Z series tongue interlock safety switches fit into the leading edge of machine guard doors to provide guard locking while also providing a double tamper-resistant interlock mechanism. In addition, the IDEM LMF series stainless steel RFID coded safety switches provide a 10mm sensing distance. The M18 cylindrical barrel BPF/BMF series safety switches offer high tolerance for misalignment after sensing and are suitable for all industry applications. All the IDEM switches are cULus and CE approved. www.automationdirect.com

WHY WEBINAR?
• Full turnkey execution, including moderator provided by Design Engineering
• Engage with the right audience
• Present relevant, interesting content
• Receive full digital marketing support over several weeks
• Full lead list provided within 24 hours of conclusion of webinar

Contact us for more details on how to book your webinar.

Paul Burton | Senior Publisher
T: 416.510.6756 | M: 416.997.0377 | pburton@annexbusinessmedia.com
A series of one day tabletop shows highlighting the latest design and manufacturing technologies for the OEM market across Canada

An effective forum for face-to-face interactions where engineers, product developers, machine builders and systems integrators can discuss, network, solicit advice and ‘kick the tires’ on the latest technologies and applications that drive your business.

April 7, 2021
DEX Abbotsford

May 18, 2021
DEX Winnipeg

June 3, 2021
DEX Barrie

June 16, 2021
DEX Ottawa

September 2021
DEX Hamilton

MARK YOUR CALENDAR!
www.DEXEXPO.com

FREE ADMISSION FOR ATTENDEES!

To discuss exhibit options please contact:
Paul Burton
Senior Publisher
416-510-6756 Mobile: 416-997-0377
PBurton@annexbusinessmedia.com
YES, IT’S TRUE.
OUR FEES ARE LOWER THAN THE OTHER GUYS.

INVEST $5,000 A YEAR IN A TFSA FOR 25 YEARS AND SEE THE DIFFERENCE.

FINANCIAL SECURITY PROGRAM
0.70% FEE = $226,200

THE OTHER GUYS
2.30% FEE = $180,000

THE DIFFERENCE IS $46,200

IT’S LIKE GETTING A FREE CAR!*
*No free car given with this program.

Opportunity is open to all participants of the Engineers Canada-sponsored financial security program, including engineers, geoscientists, students and their families.

LET’S DO THE MATH FOR YOUR FINANCIAL GOALS
CANLIFE.CO/LOW-FEES

Based on $5,000 contributed each year to Engineers Canada-sponsored Financial Security Program Canadian equity fund compared to a retail Canadian equity fund for 25 years with a 5% gross rate of return.

Sponsored by:

Canada Life and design are trademarks of The Canada Life Assurance Company.