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Photo courtesy of R+W Coupling Technology

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About as Big as it Gets.



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PTE Videos Timken Training

In this training video, Timken takes you through their Split Cylindrical Roller Bearing Housed Unit. Formerly a Revolvo product, they show and explain the ease of assembly and installation, anatomy, terminology and many key features designed to keep your operation on the move.

Check out the video here:

www.powertransmission.com/videos/Timken-Split-Cylindrical-Roller-Bearing-Housed-Units/



Editor's Choice:

Evolution of Cooling Tower Gearboxes

Without gearbox technology, cooling tower motors would be massive to directly handle the torque required by the fan. Something so large and heavy would be too expensive and impractical. Instead, the speed reduction from the gearbox acts as a torque multiplier, keeping the motor a reasonable size and the overall mechanical system more cost-effective. Read more on

SPX Cooling Technologies article online at: www.powertransmission.com/blog/evolution-of-cooling-tower-gearboxes/



Bearing Sourcing: Investigate Here

One significant and challenging issue that MROs and OEMs face is premature bearing failure in equipment. Many require bearings that can stand up to harsh environments, extremely high load capacities and operating where downtime is not an option. Read more on the Emerson Bearing Boston article here:

www.powertransmission.com/blog/bearing-sourcing-investigate-here/



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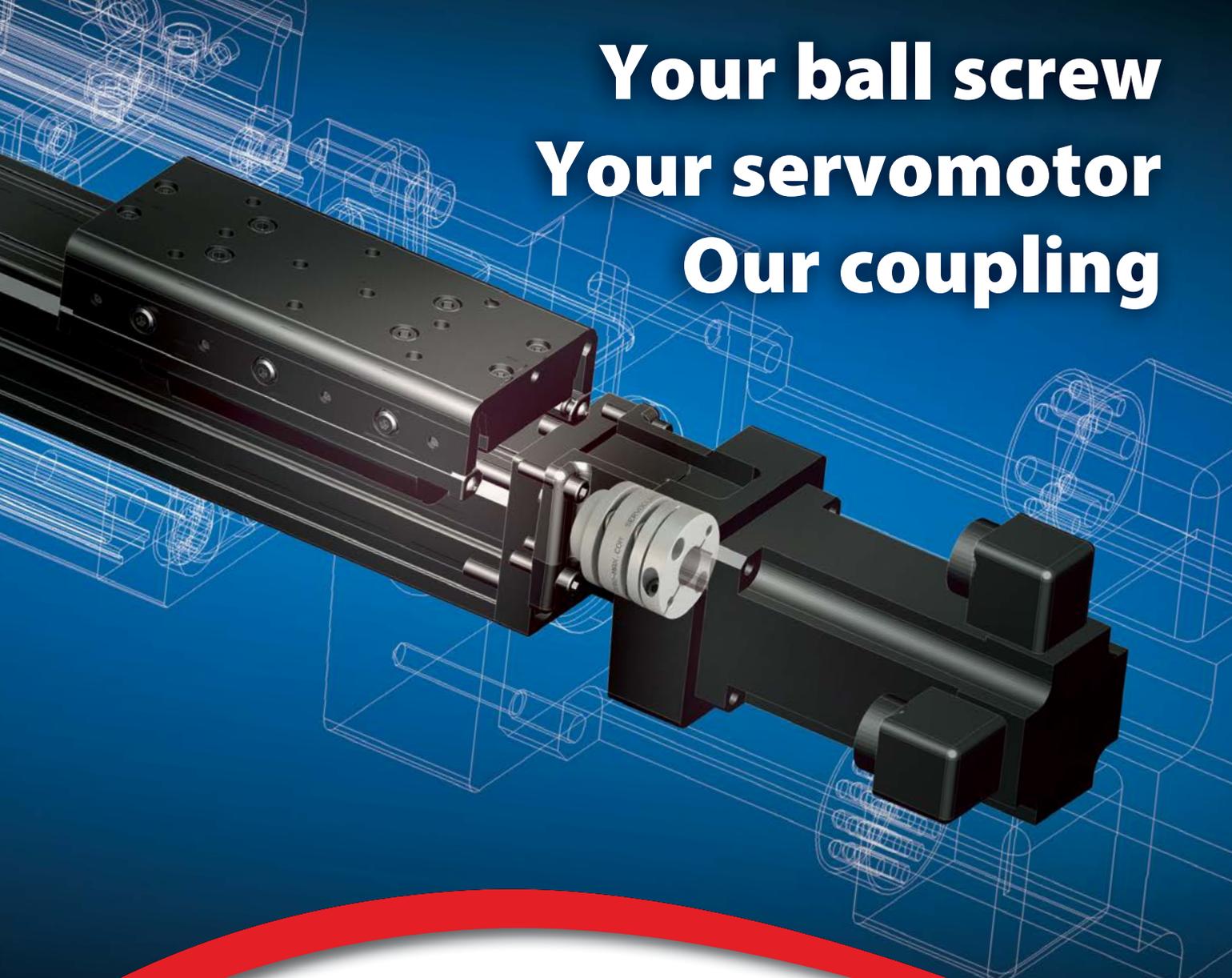
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Where to Begin?



A big trade show can be extremely overwhelming. There are so many important suppliers to talk to, it's often hard to know even where to start, let alone how to plan a strategy to maximize your time spent.

When the show is as big as IMTS, the problem multiplies.

And now the show has gone and grown again. In 2018, IMTS includes the Integrated Automation, Motion & Drives fair (IAMD USA) from the organizers of the world-famous Hannover Messe. This show has a long way to go before it becomes as relevant for buyers of mechanical components as its European counterpart. But with every iteration, the IMTS experience becomes a little bit less about machine tools and a little bit more about automation, the digital factory and the rest of the manufacturing world.

Here are just a few of the companies you might want to go and visit at IMTS/IAMD USA (2018 *PTE* advertisers indicated in bold): Aerotech, **Andantex**, Atlanta Drive Systems, B&R Industrial Automation, Bega Special Tools, CGI Inc., Cone Drive, CW Bearing, **DieQua**, Elmo Motion Control, GKN Powder Metallurgy, Güdel, HBH Gears, Iigus, **J.W. Winco**, **KTR**, Lenze Americas, **Lafert N.A.**, **Nachi America**, Neugart USA, Nidec-Shimpo America, **NSK Americas**, **Sesame Motors**, **SEW Eurodrive**, Siemens, **Shanghai Shine Transmission Machinery**, **Suhner Manufacturing**, Sumitomo Machinery Corp., Wittenstein, and many more.

The ones I've listed above only begin to scratch the surface. You can read about some of them in our pre-show coverage, beginning on page 28, and in our Showstoppers special advertising section, beginning on page 34. But you really should come to Chicago, Sept. 10–15, to experience the show for yourself. We'll be there, so visit us in the North Hall, booth #237314. If you're interested in contributing to our magazine, our editors will be happy to chat with you. Or just stop by to renew your subscription. It will only take a minute!

But my theme for this column ("Where to Begin") applies to far more than just the upcoming trade show. I'm constantly amazed at how much depth and variety we pack into every single issue of this magazine. This issue is no exception.

Our focus on couplings begins on page 16 with highlights of some of the latest and most interesting technology. That's followed by a very interesting article from Motion Industries about the effects of thermal growth and its potential to cause failure in couplings and bearings. We also hope you'll take a look at our *Engineering Showcase*, which features some of the leading coupling suppliers in the world.

We've also taken a look at design software. Our article on page 24 delves into how some of the components engineering packages have continued to grow, as well as how they keep themselves closely aligned with the manufacturing processes required to make the parts.

The food and beverage industry also take center stage this issue, with articles on pages 36, 42 and 44. If you need wash-down-duty components and systems, or automation capable of improving your system's efficiency, or food-compliant pneumatic systems, then these articles are for you.

Finally, we've prepared two great technical articles on gearboxes (pages 48 and 54), one on the potential for parasitic electric currents to cause gearbox failures, and the other on the holistic simulation of complete gearbox systems.

With all of that in mind, we're confident you'll find plenty worth reading this issue. We'd appreciate it you let us know how we're doing. Send an e-mail to wrs@powertransmission.com or come see us at IMTS/IAMD USA.

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Klüber Lubrication

OFFERS FULLY-SYNTHETIC OIL FOR RAIL GEARBOXES

Klüber Lubrication, a worldwide manufacturer of specialty lubricants, offers Klübersynth GE 480 W 140, a fully synthetic high-performance gear oil based on polyalphaolefin (PAO) chemistry that offers high stability and protection even under shock loads.

With Klübersynth GE 480 W 140, Klüber Lubrication complements its range of efficient high-performance oils for railway gears. Klübersynth GE 475 W 90, with a kinematic viscosity of approximately 130 mm²/s at 40 degrees C, has proven to be successful in the market. For applications requiring an elevated viscosity, Klübersynth GE 480 W 140, has a kinematic viscosity of approx. 250 mm²/s at 40 degrees C. This new product concept corresponds to that of Klübersynth GE 475 W 90, which is approved by many OEMs, but with a higher viscosity.

Klübersynth GE 480 W 140 offers high resistance to scuffing and micro-pitting as well as good protection against wear on gear teeth and rolling bearings. The shear stability prevents



the lubricant film from collapsing, which is essential to protect both gear teeth and rolling bearings.

The low foaming tendency and anti-corrosion properties of the product enable problem-free gear operation. Klübersynth GE 480 W 140 offers a much longer service life than conventional mineral oils, due to the excellent aging and oxidation resistance. As a result, service intervals are extended and maintenance costs are reduced.

High-performance gear oils from

Klüber Lubrication can be used in spur, bevel and hypoid gears, particularly if API GL4 or API GL5 is required. Klübersynth GE 475 W 90 is approved by several gear manufacturers like IG Watteeuw, Voith Turbo, Siemens-Flende, Stadler Rail, Bombardier, CAF and the German railway operator Deutsche Bahn.

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Joral LLC announces new stainless steel housings for all currently available sensors and encoders. Specifically designed to ensure total protection from extreme temperature fluctuation, corrosive environments, and pressure washdown. Joral stainless steel sensors are built to provide the greatest environmental protection available to provide maximum productivity.

In addition to the stainless steel housing, all of Joral's sensors are IP67 protected and rated MIL-STD 202 for shock and vibration. Stainless steel offerings include rotary encoders, linear encoders, and 3-axis inclinometers. Catered specifically to J1939 mobile hydraulics, Joral specializes in large tolerance non-contact position sensors and G-Force compensated incline sensors.

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Igus

INTRODUCES BEARING THAT ASSISTS IN QUICK, EASY LINER REPLACEMENT

Igus has introduced a new bearing, drylin W Exchange, for its drylin W linear system in which the liner can be replaced directly on the rail without dismantling the system.

By using a practical assembly tool, users can push the old liner out of the housing, clip the new one on to the shaft and push it into the housing for a flush fit. The quick and easy swap of liners will save engineers time and money while maximizing machine up-time.

“When changing the liner on the linear glides guide rail, for example where extremely abrasive sand or glass dust is present, the entire linear slide has to be pushed off the rail,” said Robert Dumayne, director at Igus. “For linear axes or multi-axis gantries with a toothed belt drive, this requires a high assembly effort and long machine downtime.”

The new bearing housing for the



drylin W linear system ensures easy changing of the liner directly on the linear rail. The side cover of the bearing housing on the linear slide can be removed easily with a screwdriver. The liner is pushed out of the carriage and removed. The replacement liner, which is made of highly wear-resistant and abrasion-resistant iglidur J200 tribopolymer material, is clipped on to the rail and inserted precisely into the slide with the assembly tool. The change is completed by putting the side cap back on the bearing housing. The assembly tool is supplied free of charge, and it can be 3D printed.

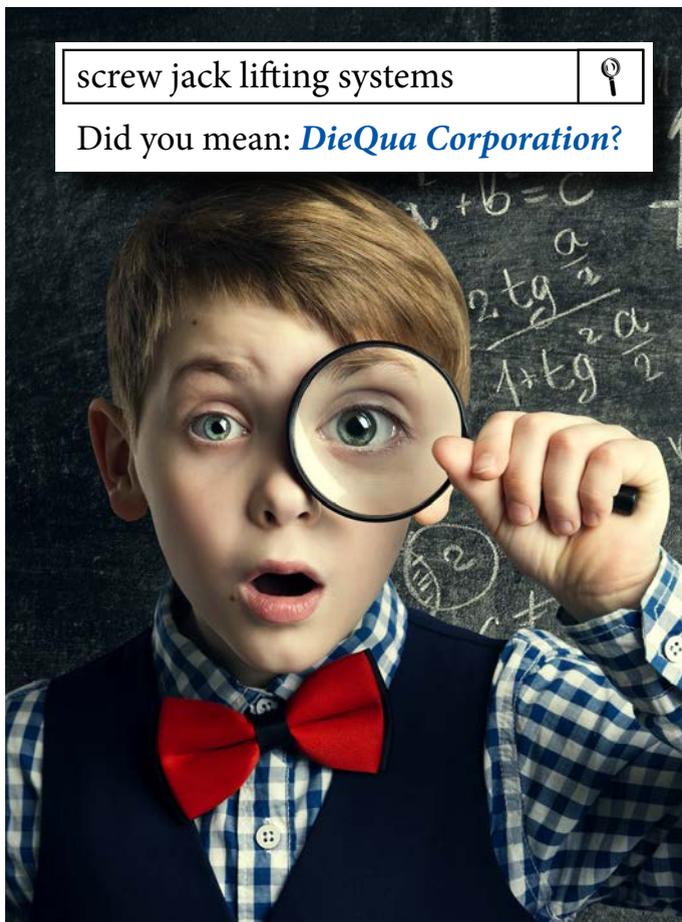
The practical benefits of the drylin

W Exchange is that the rail cannot be damaged, and replacement takes place directly on the system. A pin in the middle of the side cover secures the liner on the carriage. It can also be replaced using a screwdriver. In this instance, igus provides special recesses on the new liner and in the carriage.

The new Exchange bearing housing can be retrofitted to all existing drylin W systems of size 10 with a shaft, including guides, linear axes and linear robots. Additional sizes are currently being planned.

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ULTRA EC BRUSHLESS MOTORS OFFER HIGH TORQUE IN COMPACT PACKAGE

Portescap will be offering 2 more new length sizes under its ECT range of Ultra EC™ Brushless Slotless motors: the 35mm 22ECT35 and the 48mm 22ECT48. These new 22ECT motors along with higher torque capacity are light in weight and come in a compact package which helps in further miniaturization of the customer application.

These compact brushless motors offer almost 50 percent more continuous torque over similar comparative motors without compromising on the smooth operation and long life you expect from Portescap's brushless slotless motors. Our 22ECT motors are specially optimized for high continuous torque at low to medium speeds, maximizing power between 10K and 20K rpm.



The 22ECT motor is powered by a patented Ultra Coil Technology and patented multipolar rotor design, which provides torque of up to 41.6mNm. The 22ECT motor weighs almost 28% lesser than comparative motors and it is the lightest 4 pole motor which can be adapted in most applications in the medical & industrial markets especially in industrial hand tools where high torque light-weight motor is required to reduce the fatigue of the user. The new 22ECT is also an ideal choice for applications such as humanoid robots, lab automation equipment, electric grippers, land surveying devices.

Portescap succeeds in providing a high quality, long lasting & high performance brushless motor which is an ideal choice for geared applications because of its minimal speed drop and

low motor heating under load. Their low inertia makes them an exceptional option for applications requiring fast stopping, starting and acceleration.

The new 22ECT motors are available with hall sensors and a total of 3 different coils to match your speed & voltage requirements. Upon request, Portescap can also provide options for customization including gearboxes,

encoders, coil variations and mechanical interface modifications.

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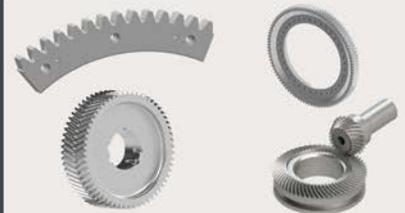
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Rexnord

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Rexnord announced the latest addition to the company's line of conveying solutions products; the Dry-PT material option is now available in North America for select MatTop and TableTop chains. Dry-PT is optimized for applications where sustainability is critical, designed to maintain a constant low level of friction between the conveying chain and the bottle, run

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Nord

PROVIDES PRODUCT DATA WITH EPLAN

Technical and electrical product data, as well as product macros for Nord electronic drive components, are now available in the web-based EPLAN data portal and can be used by all members of the portal for their proj-



ect work. EPLAN Electric P8 is one of the most important software solutions for CAD projects. EPLAN P8 provides almost unlimited possibilities for project planning, documentation and management of automation projects. EPLAN P8 product macros are available for motor starters and frequency inverters from the Nord series SK135E, SK180E, SK200E and SK500E, as well as for all Nord electronic drive technology accessories. Under the heading “Documentation/Software” on the Nord website, all currently available product macros for EPLAN P8 are also available as free downloads.

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The FQ, FP, FM and FK mobile electric drives from Rheintacho are equipped with a proven differential-hall technology for safe and reliable detection of rotational speed even in critical electrical and magnetic environmental conditions. The 2-channel design allows not only detection of rotational speed but also the direction of rotation.

In the price-sensitive market of electric drives, users can choose these sensors to match their needs regarding: the required signals, the necessary protection class for their specific applications, an interface via cable, a connector integrated into the sensor body and a wide variety of cable lengths and connector types.

The sensors can be used in a wide

A large, high-quality photograph of a racing gear assembly, showing a silver metal gear with a central shaft and a black tire. The text "Where RACING Gets an EDGE" is overlaid in large, bold, white letters. The background is a blurred green and white, suggesting a racing track environment.

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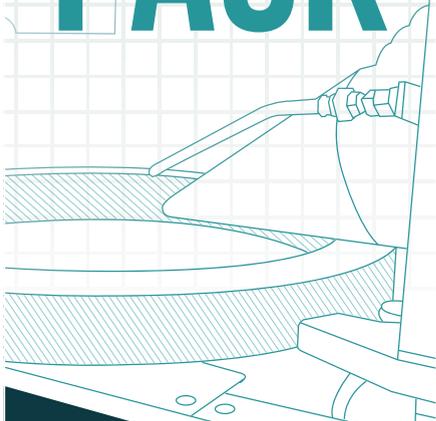
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range of temperatures (up to +140 °C) due to the housings made of high-quality plastic as well as other constructive measures. The housing material used has exceptional mechanical properties. For example, compression strength and material durability reach values that already allow for substitution of metal housings depending on the respective application. Among other features, the electrical structure provides a very wide range of possible supply voltages and a high level of EMC stability. The Hall elements which are used cover a wide frequency range. The geometric design as flange sensor automatically ensures the proper installation position required for good



signal determination.

The FK series has proven over the last decade as a kind of world-standard for speed detection inside electric drives. The FM series features connectors integrated directly into the sensor housing to its sensor portfolio. The sensor is made of a proven high-tech-plastic. The FP series comes with completely new designed sensor electronics resulting in standstill detection and high-temperature resistance. The FQ series achieves the high protection class of IP69K.

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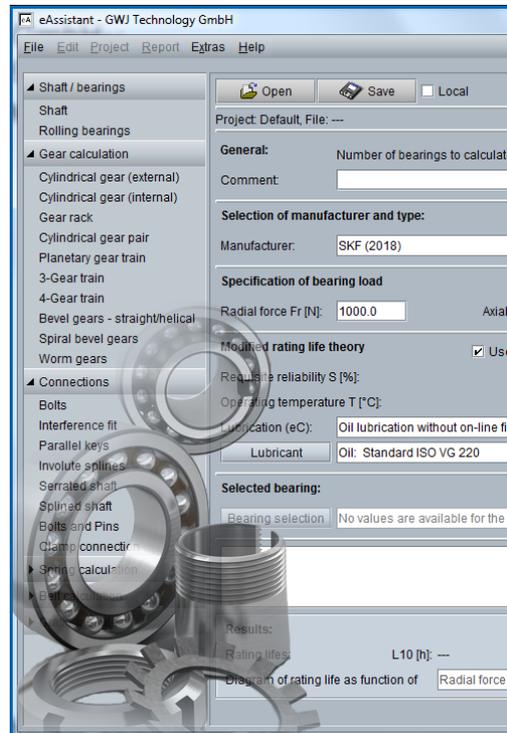
GWJ Technology

CELEBRATES 15 YEARS OF eASSISTANT

GWJ Technology GmbH from Braunschweig, Germany, is marking the 15th anniversary of its web-based calculation software *eAssistant* - the engineering assistant. The *eAssistant* software allows calculation, design and optimization of machine elements, including shafts, bearings, gears, different shaft-hub connections and bolted joints etc.

After several years of development, *eAssistant* was released in 2003 during Hannover Fair. Dial-up Internet was literally the only kind of Internet modem back then. The actual release was in May 2003 and included three calculation modules for shafts, rolling bearings and interference fits. The development process of the *eAssistant* continued thanks to the positive market response.

Further modules for parallel keys, serrated and splined shaft connections as well as involute splines were added in 2003 and 2004. At the Hannover Fair 2005, the first version of the cylindrical gear pair was introduced. Even back then, this module already included the real gear tooth form based on a mathematical simulation of the manufacturing process. Based on this, the first 3D CAD plugins for *Solidworks*, *Solid Edge* and *Autodesk Inventor* were implemented shortly afterwards. This was followed



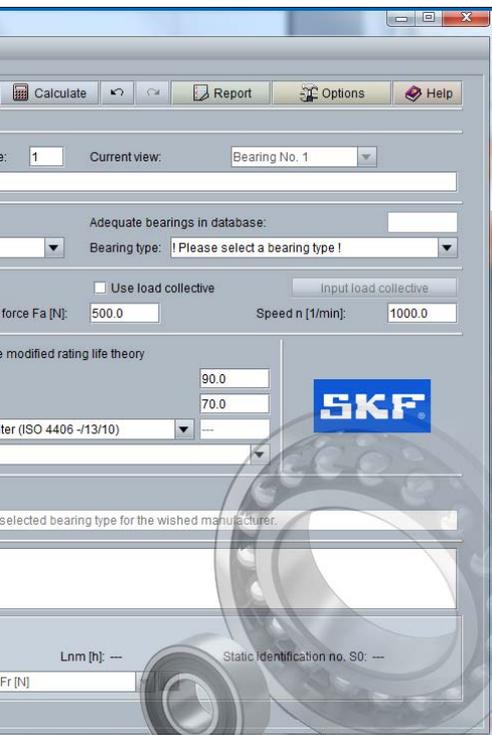
by the release of an English version and other gear modules.

Single cylindrical gears, cylindrical gear pairs, planetary gear trains, three- and four-gear train systems, gearracks, bevel gears as well as worm gears can now be determined. *eAssistant* provides different standards in order to calculate the load capacity. DIN 3990/ISO 6336 Method B or ANSI/AGMA 2101 are available. Calculation modules for bolted joints, timing belts, clamp connections and bolts and pins are also part of the *eAssistant*.

By the end of 2012, GWJ reached another major milestone *SystemManager*, a true software application for complete systems of machine elements, was released. It runs as a classic desktop application, including FE libraries. The individual system elements are directly linked to the *eAssistant* calculation modules. The software engineering process of *eAssistant* and *SystemManager* is heavily influenced by user feedback to improve the software quality. The applications are constantly being developed.

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Couplings: Designed to Carry the Pay(load)

Jack McGuinn, Senior Editor

Couplings. There certainly is no shortage of couplings—or things to couple them with. There also seems to be no lack of applications for them. You say you need to reduce the transmission of shock loads from one shaft to another? That's a classic application for shaft couplings; but really, couplings are application-intensive. They're everywhere.

A coupling is defined as a device that links two shafts together at their ends for transmitting power. If designed and installed correctly, couplings do not typically allow disconnection of these shafts during operation. However, there are—and this is just *one* example—torque-limiting couplings that sometimes slip or disconnect when things get too, well—*torquey*—and a specified limit is exceeded. Indeed, the primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement—or both. (Think of coupled rail cars and how they bob and weave their way down straight and curved track.) By careful design, best-for-application selection, and expert installation and robust maintenance of couplings, significant savings can be realized in reduced maintenance costs and downtime.

A partial list of coupling types includes:

Clamped or *compression-rigid* couplings are bi-sectioned and fitted around a shaft, thus forming a sleeve; *flanged rigid* couplings are intended for heavy loads or industrial equipment; a *sleeve* coupling is a pipe with a bore finished to the tolerance needed and to accommodate a specified shaft size; sleeve couplings feature case shaft ends that are, yes—*coupled* and fixed against each other and then encased by a *muff* or *sleeve* coupling.

Meanwhile, IMTS fever runs rampant, with exhibitors busy strategizing, finalizing booth design and doing

whatever else it takes to ensure a good showing. But in an attempt to obtain a better grasp of today's coupling technology and some industry insight, we were very lucky to catch up with a couple of gracious-but-busy guys that made some time to answer a few questions for us. That would be John Malik, Altra Industrial Motion, couplings business development manager, and Andy Lechner, R+W America product manager, flexible vs. rigid Couplings.

Just to get it out of the way, we asked the current elephant-in-the-room question.

How are the tariffs—real and threatened—and other ongoing trade machinations affecting your business and or industry?

John Malik (JM). Tariffs are driving cost increases for raw materials used by domestic manufacturers. In some cases, this puts domestic production at a further disadvantage vs. imported finished components which are not subject to tariffs. In addition, the tariff implementation requires significant resources to determine and pass along the resulting price increases. On the other hand, due to the tariffs, we've seen increased business as domestic metal mills ramp up their production.

What if any supply chain issues have arisen due to the tariffs and trade war back-and-forth? (With supply chain meaning either materials availability or available strategic manufacturing partners like, for example, machine shops and/or power transmission components?)

Andy Lechner (AL). Most likely the other commercial issue aside from potential tariff issues you don't need to hear about is the strained supply chain. It's hard to find a machine shop or power transmission component manufacturer that isn't really



ACV tri-bushing from Altra Industrial Motion (photo courtesy Altra Industrial Motion).

busy right now. But that's not limited to couplings.

JM. The first issue has been reduced supply availability because companies are buying and hoarding material in advance of tariffs. We are also seeing escalating raw steel costs. Re-shoring of production, where it makes sense, is consuming available machining resources internally and at subcontractors.

There appears to be increasing demand from certain sectors of the marketplace for both higher speeds and torque—pushing the application envelope, in fact. How is your company dealing with that?

JM. Our recent coupling product development initiatives have been focused on increasing capacities to meet these demands. We've recently increased the torque capacity of our Sure-Flex Plus elastomer couplings by 30%. We also frequently alter our gear and disc coupling products to accommodate higher torques and speeds. Applications requiring these performance increases seem to happen more frequently as time goes on. In our high-performance disc coupling range, our new patent-pending Tri-Bushing technology allows for a 33% increase in axial misalignment

capacity. This improved capability is critical in higher speed and torque applications using steam or gas turbines.

AL. One of our niche industry sectors, rotary test stands for automotive, aerospace and power generation applications, is constantly pushing the demands for high speed and high torque. Coupling speeds which we had historically only seen for lower torque applications continue to climb into larger transmission components. This can dramatically increase the required surface speeds for larger diameter couplings, and is requiring lighter materials, full speed spin testing prior to delivery, and more creative design in general.

It has been reported that certain coupling speeds typically needed only for lower torque applications are now being specified for larger transmission components. How does that affect your business?

JM. We have seen steadily increasing demand for couplings in the larger end of our product ranges. This has required us to develop larger sizes in some product lines. It's also driven significant investment in manufacturing capacity and technology as outsourcing options are more limited in larger size ranges. Higher operating speeds are driving demand of higher precision products with tighter fits, dynamic balancing and other modifications.

The popularity of full-service, one-stop (vertical) suppliers continues to grow. Do you find that to be accurate, and if so how is your company dealing with that?



This high-temperature, precision elastomer coupling's stainless steel mesh inserts allow for compact solutions (Photo illustration courtesy R+W.)

AL. We are also encountering increased demand for full service supply. This means providing minor hardware like accessory shafts and keys, as well as complete inline coupling housing / motor mount kits, and fully designed belt drive housings. This has been working out well for R+W America thanks to our new location with increased space, and our increasingly hands on technical staff. This trend of consolidating suppliers into packaging increased portions of a system is not new, but seems to be increasing.

JM. Altra Industrial Motion has continued to grow our portfolio of coupling product solutions. In recent years, we've added Guardian Couplings and Stromag to our family of world-class coupling brands that also includes TB Wood's, Ameridrives, Bibby Turboflex and Lamiflex.

Many of the larger scope projects we get involved with require a variety of coupling types to meet a wide range of specific application requirements. Our goal is to provide customers with optimized product performance combined with time-saving, single-source convenience. This capability is especially important when dealing with customers that have operations around the world.

Another advantage of Altra's multi-brand approach is that the engineering teams from various coupling brands routinely collaborate to analyze specific customer applications and then apply the latest technologies in design, materials and manufacturing. This added engineering depth provides value to our customers as it yields optimum coupling solutions more quickly, whether a modified standard product or a custom solution is required.

We have been successful as a one-stop supplier in key industries including Petro-Chem, Metals, Power-Gen and Oil & Gas with products in virtually every category of flexible couplings. We are also more focused on repair and renewal services.

In heavy-duty industrial applications, there are reports of a growing reliance on modular ball-detent torque limiters, rather than the more traditional means of protecting against overload damage in high-powered drive systems. As more production capacity is being used, the downtime to replace shear pins and reset less advanced overload devices becomes more of an issue. As self-contained, mechanically resettable torque limiters reduce downtime after overload disengagement, their value is increasing. Could you please respond to this assessment?

JM. We agree with this assessment. We have seen large increases in sales of our Bibby Modular Torque Units. These units have been designed specifically to offer an alternative to shear pins where their accurate release torque repeatability reduces downtime. These torque limiters can be factory preset or set in the field and can be combined with many of our flexible coupling products.

AL. On the heavy duty industrial side of our business, we're seeing increased usage of modular ball-detent torque limiters instead of traditional means of protecting against overload damage in high powered drive systems. The downtime to replace shear pins and reset less advanced overload devices is becoming more conspicuous as more production capacity is being used. Since one of the key advantages of a self-contained, mechanically resettable torque limiter is reduced downtime after overload disengagement, their value is increasing under favorable economic conditions. **PTE**

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Thermal Growth Issues and Solutions for Shaft Couplings

Nick Agius, National Rotating Equipment/ACHE Product Specialist, Motion Canada

I have been researching “Thermal Growth” issues for decades across North America. Many refineries and chemical plants are built with large pieces of rotating equipment in an outdoor setting exposed to the elements. This means the equipment (driver and driven) are often seeing forces beyond anyone’s control called “Thermal Growth.” This is especially true in colder climates (Zones 1 to 4).

The trouble is that often the root cause of the coupling or bearing failure is not identified by the reliability team at the end-user level. The actual equipment foundation is seeing massive forces as the ground heaves to frost. These forces are slow and unavoidable—the result is a shaft misalignment. This is hard to detect if you do not know what you’re looking for, but the tell-tale sign is that this issue is seasonal. For example, the bearing or coupling fails every autumn or spring.

The first common mistake is when coupling failure is not properly recognized by maintenance. They often think they did a poor alignment job. As the coupling fails, they focus only on that part. They usually ask their power transmission supplier for a better shaft coupling that can handle more misalignment, which is the second mistake. They may also buy some laser alignment equipment to help with the process, which is never a bad investment. Many shaft coupling manufacturers advertise massive shaft misalignment capabilities, as that sells the product. Having a shaft coupling to handle excess misalignment is what the uninformed maintenance technicians are requesting. The issue is the coupling insert may be able to handle the misalignment, but the bearing on either side cannot, so we are simply passing the unidentified issue to the next piece of rotating equipment which is usually the bearings.

The next issue, after they feel they have solved the coupling, is the bearings start to fail (seasonally). The next call is typically to the bearing supplier, as the root cause has not been clearly identified yet. Now a process is started to redesign the bearings and find solutions to an unidentified rotating equipment condition. If the technician is lucky, he or she is calling the very same supplier who supplied the coupling. If the supplier has technical aptitude, they may start to ask some questions and realize this issue may be more than the local team thinks. First coupling issues, now bearing issues on the same unit?

In today’s fast-paced world it is easy to get blinded by too much information, yet not see the real issue(s). If the supplier or end-user has access (internally or externally) to an experienced

rotating equipment specialist, this is the time to ask for outside technical support.

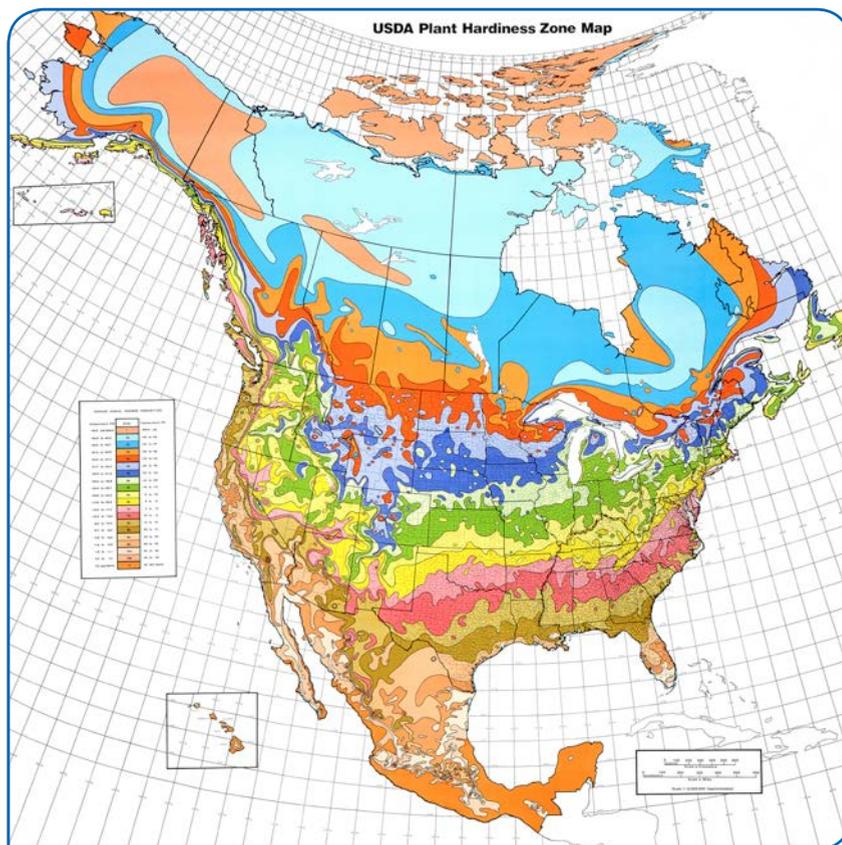
A skilled rotating equipment specialist will step back and perform a “Root Cause Failure Analysis” of the broken parts (coupling and bearings). Often, the end-user is not willing to spend the time or money, so the issue is not yet properly identified and the costs rise.

Now let’s focus on the best solution.

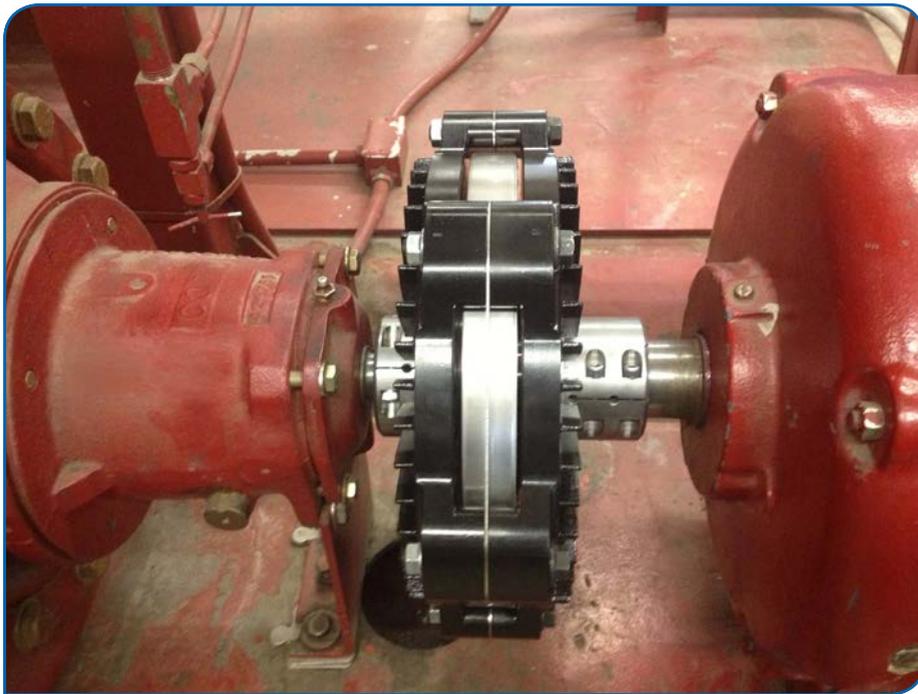
From my experience, I have discovered that the best way to deal with slow seasonal thermal growth is to use a shaft coupling with no connection between the driver and driven.

Does this exist? Yes it does: think magnets!

Magnetic couplings depend on an air-gap and powerful magnets between the driver and driven. They are one of our industry’s best-kept secrets. If



Thermal Growth, especially in colder climates, can be the root cause of coupling or bearing failure.



Magnetic couplings in service.

they had a lower cost, they would be more mainstream so they need to be solving an equipment issue to be considered. The air gap is not a physical connection, so if the equipment shifts

seasonally within the magnetic couplings' ability, then the misalignment is absorbed and not passed to the bearings or other parts of the machine.

Magnetic couplings solve another

issue as well. If we need a soft start between driver and driven to absorb start-up or a shock load. This is a market which fluid couplings have targeted and done very well. A fluid coupling will not solve a thermal growth issue and it requires transmission fluid to be inside the coupling. No shaft coupling can handle both issues articulated in this article as effectively as a magnetic coupling.

- Magnetic couplings will create a slight bit of speed slip so this needs to be taken into consideration
- Magnetic couplings can handle massive misalignment, as shown here, up to .300"

Magnetic coupling suppliers have a unique ability to install shims to allow for more slip. Think about the possibilities and why this is so revolutionary. I will give you one very common application where this concept is so very unique (and needed). The image at the bottom of page 20 shows a typical cooling tower application. The fan

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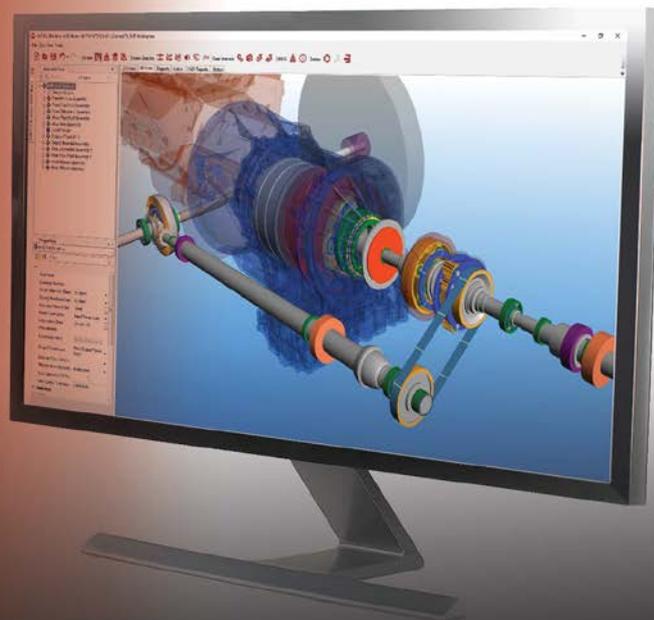
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inside the velocity stack is driven by a large motor and coupling as shown here. The coupling shaft goes into the middle of the tower and drives a right angle gearbox, which has a large axial fan on the output of that gearbox. The fan blade pitch is set for the lowest ambient temperature year round so the motor will not kick out when the air gets colder and heavier.

This is another seasonal issue we need to deal with in Zones 1 to 4. If the motor has a variable frequency drive (VFD), the seasonal issue doesn't occur as the fan blade-pitch is set to be more aggressive in the hotter summer months, then the VFD simply adjusts the speed down, allowing the motor to stay under full load amps (FLA) during winter.

Years ago, most end-users in northern zones would set a winter and summer blade pitch to maximize the performance of the axial fan. Today this is not as common, due to safety issues inside these large, wet towers. A wet cooling tower is a nasty environment. Google "Cooling towers and Legionnaires' disease." The less anyone has to go inside a tower is the better.

Now the real benefits of this magnetic coupling are revealed. Think



Outdoor boiler feed pump at a refinery in Canada with thermal growth issues due to seasonal pipe strain.

about how easy it is to adjust a set of shims on the outside of the tower, to slow the fan speed down a bit, so summer blade-pitch can run all year. This adjustment is easy to do quickly, for less cost and much safer. No confined space permit.

The other massive benefit of this magnetic coupling, in a cooling tower, is the "soft start" capability that the

coupling inherently has. This allows the gearbox, fan and shaft coupling a much longer component life due to less stress. If the cooling tower is wind-milling (which is very common) this magnetic coupling also solves that issue as well.

Magnetic couplings have ventured into full adjustable speed drives (ASDs), which is so very unique. Electrical variable frequency drives (VFDs) have a lot more baggage than most end-user identify with. VFDs require new wires, and they also require more space in the MCC room, which older plants simply do not have.

Consulting with a rotational equipment specialist is recommended to analyze VFD issues which show up in the form of a torsional vibration. There is one paper in the reference section below that is worth reading. A magnetic ASD will never create a torsional vibration issue due to design.

There are two leading magnetic coupling manufacturers that seem the same on the surface, but you need to do your homework, because each uses different magnetic technology. I personally prefer the magnet that delivers 140% torque during slip (start-up) over the Eddy Current technology that drops off and generates more heat during start up (slip).



Flux Drive's rotor design provides full torque/power when needed for high-starting torque loads.

Conclusion: Thermal growth issues in rotating equipment are not easy to identify, so we can waste time and resources chasing the wrong solution(s). Consult with a senior rotating equipment specialist or do you own detailed “Root Cause Failure Analysis.” This article was built to reveal the issue(s) and possible solution(s). This article went one step further to show how this unique magnetic coupling technology has helped solve another seasonal issue for cooling towers using the same magnetic technology. **PTE**

For more information:

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motionindustries.com

References

1. Troy Feese, “Torsional Vibration Problem with VFD motor/ID Fan at an Oil Refinery,” ReliabilityWeb.com, 2014
2. Richard Braun, “Flux Drive FSC-5 Smart Coupling- Torque/Power Testing Report on a Cooling Tower,” Case Study, May 2017
3. Marc W, Yarlott & M.Azeem, “Smart Couplings Enhance a Failing Hot Oil Pump at a Wastewater Treatment Plant”, *Pumps & Systems* magazine, May 2015
4. Richard Braun, “Stickney Water Reclamation Plant, Chicago Illinois,” Case Study
5. Richard Braun, “City of Columbus, Jackson Pike WWTP, Ohio,” Case Study
6. <https://www.thefanguy.ca/>, FAQ, “How Do I Manage Winter Blade-Pitch with Colder, Heavier Air?”

Nick Agius is a rotating equipment specialist for Motion Industries. His Anti-Rotation Device (ARD) solution for Canada and the US was first patented in 1996, followed by two other patents. Visit MotionIndustries.com or for industrial training opportunities, visit MotionInstituteOnline.com.



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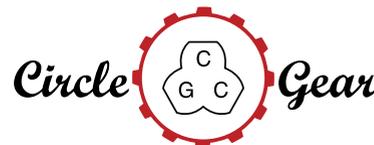
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'Excellence in Design & Manufacture' is more than just a tagline for **System Components, Inc.** Long prior to our incorporation in 1974, Eugen Gawreliuk, founder and President of System Components, had a dream to abandon the world of large corporations to *design and manufacture* a company of his own where he could combine his passions for consulting and manufacturing with a group of innovative, problem solving employees with compassionate customer service.

coupling line offers the highest speed and torque rating for their size of any coupling on the market, up to 8 degrees of misalignment, torque ratings up to five times higher than competitive products, requires no lubrication, cushions shock loads, dampens torsional vibration, and is electrically insulated.



In an effort to further diversify the company, System Components partnered with international manufacturers to bring you Disc Couplings, Flextork® Rubber Industrial Couplings, and Howdon's Wedgegard™ a unique alternative to traditional shear pin torque limiting.

In just over 50 years, System Components, Inc. has been able to go from one man with a dream, a drill press, and an engine lathe to a highly-respected company with the ability to manufacture couplings up to 47" in diameter, for shafts up to 27", over 60 machines, 45 employees, and countless loyal customers who's partnership encourages us to continually improve the work we do every day.

The company was born contract machining for various power transmission applications until 1980 when a screw compressor manufacturer reached out and awarded Eugen his first large contract. Today, that is still a very important relationship for the company.

Already having experience designing special couplings, System Components launched the Powertork® line of Flanged and Continuous Sleeve Gear couplings along with the Flextork® line of Elastomeric Element Couplings.

In 2007, System Components earned the ISO 9001 certification and has continued to improve and maintain that to this day.

System Components' Powertork® Gear Couplings were designed to interchange flange-to-flange with other industry standard manufacturers, whereas the Flextork® Elastomeric Coupling is a completely unique, drop-out rubber element style coupling.

To stand apart in the well-established Gear Coupling market, System Components offers Grade 8 bolts, O-Ring Seals, and manufactures from forgings. The Flextork®



Mapping the World of Manufacturing

After decades of iteration, you might think manufacturing software suites are running out of new modules to add, but improving hardware is opening up new avenues for them to explore.

Alex Cannella, Associate Editor

Every month, press releases for engineering software show up in our inbox, extolling the latest advances and most cutting edge modules just introduced to the suite. Every month, we find something new to design, measure, calculate and simulate mechanical components. And when you look at some of these software suites, they've been doing this consistently for years, decades even. KISSsoft alone has roughly 190 different calculation modules covering everything from gears to bearings.

Which raises the question: With such comprehensive software, what could even possibly be left? What corners of the mechanical universe have we not somehow mapped yet?

The simple answer is, probably unsurprisingly, that we still have plenty of places. The more interesting answer, from Dr. Stefan Beermann, CEO of KISSsoft AG, is that we will never just run out of new designs to make. Or at least, in the field of gearing, we won't.

"There are some standard gears out there you can buy, but usually a gear is not a standard part," Beermann said. "It's something which is designed to a specific purpose. Each time, freshly. Of course, based on experience you have before, usually you modify something... We won't run into the situation that we won't design gears anymore. It might be always the same criteria or the same software we're using, but this will be an ongoing job to design new gears because the requirements keep changing."

As with anything else, gear designs are constantly being improved and technology is pushing the limits of what we can make with them. Machinery is

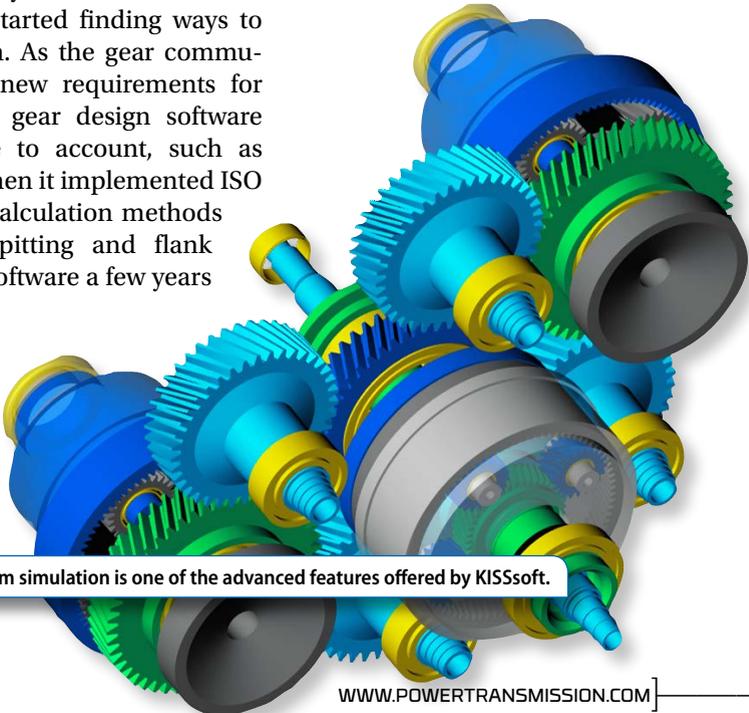
getting more accurate, allowing gears to be cut more precisely and run more quietly, combating a primary issue that many gear manufacturers deal with. Gears are getting smaller and stronger. They're made from new steel alloys and undergo new heat treatment techniques. Every step of the process is always being improved, and software needs to incorporate those improvements. Even if a software suite already has a module to calculate the dimensions of a double helical gear, it's still important to update the software to account for how a new cutting or heat treatment technique might affect the workpiece.

And that's just accounting for the march of technology, not even customer demand or regulations. ISO standards change regularly, including the relatively recent changes relating to micropitting and flank fractures for gears. While these types of failure mode have always been around, we've only recently started finding ways to deal with them. As the gear community develops new requirements for best practices, gear design software has to change to account, such as KISSsoft did when it implemented ISO standards for calculation methods treating micropitting and flank fracture in its software a few years ago.

While the day-to-day work of keeping up with the latest in the industry may be a primary focus at KISSsoft, that doesn't mean they're out of modules to develop, either. On the contrary, improving computer hardware is opening up more and more new avenues for the company to explore. There are a lot of calculation methods that, while technically possible, take so long that they're impractical to actually utilize. But as computer hardware grows more powerful, software companies at last have the tools to start exploring these new avenues.

According to Beermann, the computing power of yesteryear made this a complete impracticality, something that would take weeks to calculate, but with today's hardware, they've gotten the process down to just a matter of hours.

KISSsoft is also working to merge its individual calculating processes into a



Whole system simulation is one of the advanced features offered by KISSsoft.

single model. A growing focus is on tying these disparate modules together, either to allow multiple calculations for a single workpiece to be shown at once, or to allow the simulation of full systems of parts.

“We’re still not there that we can model everything exactly in full reality—this will never be possible—but it’s getting closer and closer to that point,” Beermann said.

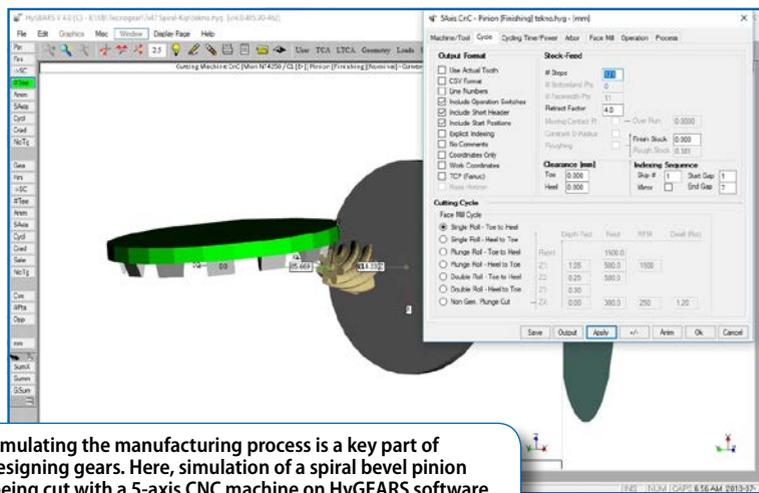
In particular, Beermann is seeing a trend towards modeling an entire system, such as an entire gearbox, which means modeling and calculating for every individual part in that system—simultaneously. When you have to calculate an entire system at once instead of just a single workpiece, the computing power required increases exponentially, but here again, we’re reaching the point where hardware is finally getting strong enough to accomplish exactly that. The most recent and complex example that Beermann has seen was a model of a complete drive train for a tractor, and applications are only bound to get more complex from here on out.

With gears especially, you can’t design a part without knowing how it’s going to be manufactured, and the connection between gear design software and the machines and tooling used to manufacture the parts is extremely important. That’s one of the key reasons KISSsoft was acquired by the Gleason Corporation in 2017. It’s also why KISSsoft now integrates with the GEMS software that runs Gleason machine tools.

That integration between design and manufacturing are where other software providers also find their niche.

HyGEARS, developed by Involute Simulation Softwares Inc., is 3-D gear engineering software for the design, kinematic analysis, optimization and manufacturing of a wide range of gear types. HyGEARS’ niche seems to be flexibility. “HyGEARS is manufacturer independent,” says Dr. Claude Gosselin, president of Involute Simulation Softwares, “which means that the user can have gear cutting machinery from different sources on the shop floor and still be able to address significant production batch sizes for different gear types without the need for the machine manufacturer’s software.”

According Gosselin, small- and even some medium-sized manufacturers are



Simulating the manufacturing process is a key part of designing gears. Here, simulation of a spiral bevel pinion being cut with a 5-axis CNC machine on HyGEARS software.

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Contact: Meike Sauer	Tel. +49-511-89 34114	Email: meike.sauer@messe.de
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Hannover Milano Fairs Shanghai Ltd.		
Rm. 301 B&Q Pudong Office Tower 393 Yinxiao Rd. Pudong Shanghai 201204, P.R. China		
Contact: Ms. Ally Huang/ Mr. Jimmy Yang/ Ms. Wo Zhao/ Ms. Sophia Bo/ Ms. Sunny Sun/ Mr. Martin Xu	Tel. +86-21 5045 6700*252/225/215/322/251/558	Email: ptc-asia@hmf-china.com
	Fax +86-21 5045 9355 / 6886 2355	Website: ptc-asia.com

left with only a few options. You can pick niche software that might only work for one or two types of gears, or just bearings, or whatever you're looking for. And if you get an order for something outside of that software suite, you have to make do and hope you have a technician with the experience to set up machines manually. Or you can go for a more comprehensive software suite that can cross those lines, but it doesn't come cheap.

For smaller manufacturing outlets in particular, that's a tough call. On the one hand, smaller parts manufacturers, especially gear manufacturers, have to deal with differing sizes of lots and types of parts on a frequent basis. On paper, larger outfits can churn out large lots of one gear all day, while smaller manufacturers that don't have that economy of scale instead have to take on many different, smaller orders, which means they're the ones that need that flexibility most. But they're also the ones without a massive operating budget, meaning the high price tag of an all-inclusive software suite that would offer that flexibility would be more onerous for them. Purchasing multiple pieces of software is equally financially prohibitive, reaching the same levels of costliness where you might as well just buy the single, comprehensive suite.

"For a number of companies, it is dramatic," Gosselin said. "If you even, at 38 to 40 grand, which is the typical selling price for HyGEARS, some manufacturers just decide not to go ahead because they can't afford that amount of money... In some cases, I'll lose the sale because even my price is too high, so if you compare this with other software, it's totally out of reach. I think this makes quite a significant difference into what people can afford to do or get to do."

Now, this all is a burden that's largely placed on small manufacturers, not necessarily the part buyers they cater to. But it does create an environment where specialization in a certain field is gently encouraged, and the effect of that can theoretically extend down the line. Software is a vital part of the manufacturing chain, so if manufacturers can't afford software that can manufacture

parts in multiple fields, that means fewer multi-specialist manufacturers you can buy from, and having to shop around for more individual parts cobbled together from multiple shops.

Now, none of this is to suggest that we're entering an apocalyptic scenario where we're going to wake up tomorrow and notice small manufacturers have been squeezed to death by software prices. Far from it! But as with any other system, the industry can always be improved, and this highlights an underserved area that software developers have an opportunity to grow into.

It's also an area that Gosselin is trying to explore. He's working to make HyGEARS an affordable software suite that can break some of those barriers. The software can't handle every gear under the sun, but it can work with a wide range of bevel and helical gears, as well as involute splines, face gears, and spiral face clutches. But that's only for now. The most recent step HyGEARS has made is a leap into couplings, expanding support to cover Hirth coupling and clogged teeth couplings. And much like KISSsoft, HyGEARS is working to keep with the times, adding support for Skiving, for example.

Gosselin has also found success with HyGEARS helping parts buyers start manufacturing their own parts instead of shopping around for them.

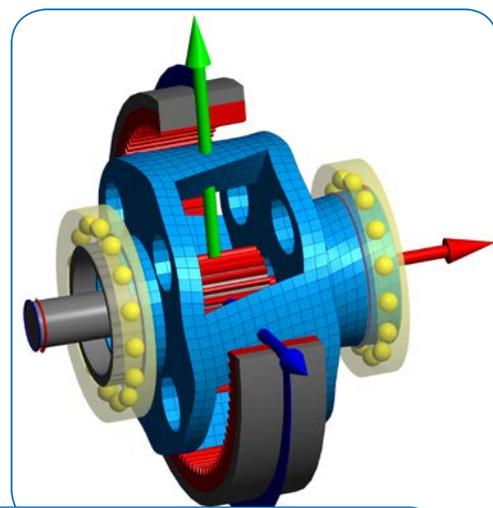
"Some HyGEARS customers [small companies] used to buy from outside vendors," Gosselin said. "After purchasing the correct software (HyGEARS in this case), combined to in-house 5-axis CNC machines, they became self sufficient: they now control the design and manufacturing and their products offer consistency."

HyGEARS, of course, isn't the only affordable option on the block. MESYS is similarly trying to offer an affordable alternative to massive, all-encompassing software suites. Unlike HyGEARS, however, MESYS' primary domain is shaft system and bearing calculations, and they're sticking to what they specialize in. As a younger program compared

to other options on the market, originally released in 2010, MESYS still has plenty of room to potentially expand, but the focus currently is on improving their already existing features.

"There are companies that don't need the whole range. There are customers who are just bearing manufacturers," Markus Raabe, director and owner of MESYS, said. "They want bearing calculations and they need shaft calculation because the bearing is not alone. They don't need gear strength calculations... If it were just standard gear ratings according to ISO 6336 or AGMA 2001, there are many programs on the market. Better deliver something that is not available in other programs."

It's an opposite view from Gosselin's, but here again, seeking out a niche where there isn't as much competition makes perfect sense from a business perspective.



MESYS software specializes in the simulation of elastic deformation, as shown in this carrier body example.

So what has MESYS been doing to improve in their field? Like other software companies, MESYS' main focus recently has been on expanding the software's ability to do integrated finite element calculations.

"For several years now, it was possible to import a housing step file that is both meshed and reduced within the software and then it could be considered as a housing stiffness," Raabe said. "Now this is extended so that not only reduction is done to one node for a bearing ring, but elastic deformations

of the bearing ring can be considered, and also that elastic deformation of gears can be considered.”

But while MESYS might be taking an opposite approach from HyGEARS, they do still make concessions towards interconnectivity with other software. Namely, it doesn't feature gear strength calculations of its own, but is designed to be able to connect with gear calculation suites. Namely, MESYS integrates with eAssistant and TBK software from GWJ Technology, as well as the Gear Production Suite produced by Dontyne Systems. MESYS may be focusing on specializing, but they're also not siloing their software away.

Camnetics follows many of the same patterns that other companies do. They produce gear design software that's intended to be used for manufacturing. Their GearTrax and GearTeq software is used to create solid models of gear components for easy inclusion into CAD programs.

Gregory Hottman, president of Camnetics, highlighted several parts such as worm wheels and spiral bevel

gears that they're working to improve the accuracy of their models for. Currently, Hottman recommends the software only be used to model these more complicated gears.

“When they're cutting the tooth on a machine, there's overcutting and undercutting going on that the machine can compensate for,” Hottman said. “We really can't compensate for that in the CAD world yet.”

But Hottman wants to change that. It's still an ongoing process, but Camnetics has already made some efforts towards tackling the issue. Most notably, Camnetics has added a cavity cut method that extracts cutter parts to the gear model.

Meanwhile, they're also looking to expand into simulating full gear sets for cycloidal gears. Currently, Camnetics can do a cycloidal gear with a pin, but they're working to expand that.

While not quite on the same level as simulating an entire drivetrain, it's still a move in the same direction other software developers are going: expanding to include more moving parts, which

is the current frontier for the bleeding edge of software development.

But more interestingly, once you look under the gloss of the big software companies pushing the boundaries of the field, you see other gaps like what Gosselin is trying to fill with HyGEARS, areas where the limitations aren't technology, but economics. It's a different beast to wrestle with, but it's no less of an important one. **PTE**

For more information:

Camnetics
Phone: (608) 835-2378
www.camnetics.com

HyGEARS
Hygears@hygears.com
www.hygears.com

KISSsoft AG (A Gleason Company)
Phone: +41 55 254-2050
www.kisssoft.com

MESYS
Phone: +41 44 455-6800
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A One-Stop Manufacturing Shop

Hannover Messe USA Continues to Expand IMTS Portfolio

Matthew Jaster, Senior Editor

Are you interested in all the manufacturing technology and innovation found at Hannover Messe in Germany?

The Industrial Automation and Motion & Drives trade fairs are combined at IMTS this year in order to create a cross-platform for power transmission, fluid power and automation.

The Integrated Automation, Motion & Drives USA fair will boast 490+ exhibitors from 18 different countries. Attendees won't need to traverse across 35+ pavilions to find individual components or complete systems that boost the efficiency and reliability of their production processes. All the technology will be on-hand at McCormick Place in the East Building (Lakeside Center).

Peter Eelman, vice president of exhibitions and communications for AMT, said the original reason AMT collaborated with Hannover Fairs was to expand the scope of IMTS.

"IMTS started as a general machine tool show and then it moved beyond that into factory automation. Today, we're basically building a one-stop shop concept. The breadth of manufacturing that is now covered when you add the Hannover Fairs pieces with the IMTS pieces, there's not a person at a manufacturing facility that would not benefit from attending the show," he said.

Here are a few highlights from the East Building this year:

The Digital Factory

The Digital Factory at IAMD USA will showcase IIoT solutions that optimize plant processes and accelerate the development of new products to conserve manufacturers' resources and lower their production costs. Digital Factory will feature software and wireless technology innovations, digital twin, production monitoring and control systems, IT security and more solutions for the entire production process.

"We are excited to launch Digital

Factory at IAMD in the U.S.," said Adrienne Zepeda, show manager of Industrial Events at Hannover Fairs USA. "The world's top industrial technology and digitization innovators will demonstrate IT-optimized smart manufacturing and IIoT solutions, offering attendees what they need to implement smart, transportable data and connections on and off the plant floor," added Zepeda.

For the first time on the show floor, Digital Factory at IAMD will display Enterprise Resource Planning ERP, Supply Chain Management, Process Integration, Product Lifecycle Management (PLM), Visualization, Manufacturing Execution Systems MES and Virtual Commissioning, Offline Programming and Set-up and other IIoT solutions all in one area. Leading technology providers in the space include SAP, Infor and FORCAM to name a few.

Solutions Theater: Adopting IIoT Strategies

The Solutions Theater will educate attendees about the latest processes, standards, trends and implementations for the plant floor and beyond. Leading industry speakers will explain the adoption of IIoT, providing clear details on how to move forward and adapt to the fourth industrial revolution.

Top innovators and experts in the field, including Bluetooth, German Plattform Industrie 4.0, Industrial Internet Consortium (IIC), Manufacturing Leadership Council, Mechanical Engineering Industry Association (VDMA) and National Electrical Manufacturers Association (NEMA), will participate in these discussions.

"We are excited to bring these global industry organizations to the trade show floor to provide speakers and develop content for the educational sessions, panels and keynotes," said

Zepeda.

On Monday, September 10, HFUSA will host an opening ceremony in the Solutions Theater, and the German Plattform Industrie 4.0 will hold a special program (in partnership with the IIC, NEMA and Manufacturing Leadership Council): Industrie 4.0 Meets the Industrial Internet of Things (IIoT). On Wednesday, September 12, VDMA will host a conference program of morning and afternoon sessions covering smart manufacturing and predictive maintenance.

On Friday, September 14, the Industrial Internet Consortium will host a morning of presentations and panel discussions followed by a networking reception on the trade show floor. IIC discussions will focus on technologies disrupting the manufacturing industry: The Industrial Internet of Things, Cybersecurity, Automation, Time Sensitive Networking (TSN) and Artificial Intelligence. Experts in manufacturing, automation and security will showcase IIC case studies about how new technologies shape machine interoperability, manufacturing quality improvements, real-time control and synchronization of high-performance machines, equipment failure predictions and more.

"Partnering with these outstanding industry experts for the new Solutions Theater programs and demonstrations will bring great value to Hannover Messe USA attendees," added Zepeda.

Taking it to the Next Level

Due to the strong manufacturing economy, IMTS 2018 has opened additional exhibiting space on Level 2 of the East Hall. Here you'll find 340+ exhibitors in areas like machine components, cleaning, environmental resources, controls and CAD-CAM.

Exhibitors showcase reclaim, reuse and recycle technologies, products for washing, purification, filtration and separation, material handling systems,

and motion control components, as well as environmental management software.

After visiting Level 2, head up to Level 3 where another 65+ exhibitors are displaying products and technologies for CAD-CAM, quality assurance, EDM, automation and motion and drives.

Exhibitor Previews

The following section includes previews from exhibitors in areas of manufacturing covered in the pages of *PTE* magazine.

Lafert North America

BOOTH E-121050

Lafert N.A.'s HPS Series permanent magnet (PM) synchronous AC motors deliver IE4 Super Premium energy efficiency while reducing motor size and weight by up to 50 percent. The HPS Series combines the mechanical design of the standard induction motor with the high performance and energy efficiency of the brushless servo motor design. This uniquely engineered product was inspired and made possible through decades of Lafert experience and expertise in the design and manufacture of both motor designs.

The target of the HPS Series is motor-driven HVACR equipment such as pumps, fans, compressors and blowers



where system size, weight or operating costs are key design considerations. The IE4 Super Premium energy efficiency levels achieved by HPS Series motors deliver significant energy savings (up to 14%) when compared to EISA Premium AC motors. The energy efficient performance of HPS Series motors allows equipment manufacturers to exceed minimum energy performance standards (MEPS) while

reducing ownership costs.

Additionally, the HPI Series combines each high performance HPS Series permanent magnet motor with a matched variable frequency drives (VFD) design to produce seamlessly integrated motor and drive solutions. The onboard Lafert drive technology and control interface, deliver optimized system performance and energy efficiency without costly and time-consuming integration of discrete motor and drive systems.

For more information:

Lafert North America
Phone: (905) 629-1939
www.lafertna.com

B&R Industrial Automation

BOOTH E-134111

B&R Industrial Automation Corp will introduce track technology enabling The Adaptive Machine at booth E-134111. An adaptive machine has the capacity to change over on the fly, and moreover, to reconfigure with different production modules on the same base machine platform.



This new generation of production machinery is readily adaptable to constant size and format changes. In addition, it is reconfigurable to radical and unforeseen requirements through corresponding equipment changes, such as replacing a welding module with a forming module.

Adaptive machines are defined by individually controlled modules with multidirectional movement, tight synchronization with other (often robotic) devices, and exceptional production flexibility. Adaptive machinery will compare favorably in all aspects of productivity measurement—OEE,

ROI, TCO—as lot and batch sizes shrink and throughput (lead time and volume) requirements remain critical.

Additionally, IMTS attendees can also discover the world's first field device for OPC UA. The new X20 I/O system bus controller makes it possible to implement OPC UA communication from the sensor layer to the ERP layer without any interfaces whatsoever.

B&R has further expanded its portfolio of modular *mapp* software components. IMTS attendees will also be introduced to the new *mapp RoboX* and *mapp Teach* that make it faster and easier than ever to get robotic systems configured and ready for operation.

IMTS attendees will also learn about HTML5 based HMI development using the new *mapp View*. For the first time, automation engineers have all the tools they need to create powerful and intuitive web-based HMI solutions—without the need to learn *HTML5*, *CSS* or *JavaScript*.

IMTS attendees will also learn more about the *SafeDESIGNER* library for press applications. B&R is one of the first manufacturers to offer a complete set of the function blocks specified in PLCopen Part 4. As a result, users working with safety-critical press applications will have a much easier time setting up the necessary safety functions.

For more information:

B&R Industrial Automation Corp.
Phone: (770) 772-0400
www.br-automation.com

Siemens Industry, Inc.

BOOTH E-134500

At IMTS 2018, Siemens Industry, Inc. will present its Sinumerik CNC hardware and software solutions, offering dual tracks for the machine tool builder and end-user attendees from job shops and production departments of all types. Advancements in machine tool automation will be demonstrated for various CNC machines—from basic milling and turning applications to multi-axis machining centers and the fully automated, flexible work cells used throughout the manufacturing

industry. In addition, Siemens will display its new *Mindsphere* “software as a service” concept, which enables machine tool users to gather, prioritize and access data in real-time, using edge technology.



Reflecting the company’s drive to the digital factory, a virtual experience for machine tool design and build functions will be presented to the OEMs, while end-users will experience how the machines used on their shop-floors will be operated, managed, programmed and maintained in the future. In combination with the advanced motion control technologies and PLM services offered by Siemens, the full process chain from CAD to CAM to virtual simulation to production and performance assessment will be on display.

Siemens offers the machine tool builder an entire portfolio of CNCs, plus the integration

of robotic machining and solutions for additive, in tandem with the advanced automation scenarios of today’s manufacturing environment.

Likewise, Siemens has taken a major step on the road to digitalization with *Mindsphere*, which offers machine tool builders and end-users alike a variety of customizable software and application options for the control and maintenance of their operations.

Mindsphere is a “software as a service” concept in which Siemens offers a wide range of services for manufacturing companies on the path to Industry 4.0. *Mindsphere* is an open IIoT operating system, allowing a customized platform for recording and analyzing large volumes of plant-wide production data. A customer can interact with Siemens to devise a variety of MindApps for machine tool predictive maintenance services, energy data

management and even resource optimization development.

For more information:

Siemens Industry Inc.
Phone: (847) 640-1595
www.usa.siemens.com/cnc

IKO International

BOOTH E-134333

For applications requiring high rigidity, increased load capacity, superior accuracy and maintenance-free operation, IKO offers the C-Lube Linear Roller Way Super MXL Master Grade. This model is part of IKO’s C-Lube Linear Roller Way Super MX family, which features a range of load capacities and mounting configurations.



The Super MXL Master Grade low fluctuation specification provides high-precision feeding. The special raceway processing suppresses small running deflection which reduces fluctuation by about 50% compared to other extra-long units. Low fluctuation is ideal for ultra-precision linear motion on machine tools that require high-precision, high-quality processing; while the extra-long unit improves load capacity and rigidity in mechanical equipment.

The C-Lube lubricating element features a unique capillary system consisting of a porous resin part integrated in the recirculating path of the end plate. As rollers circulate within the linear guide, lubricant is continuously distributed to the loading area along the track rail. The result is maintenance-free operation guaranteed for five years or 20,000 kilometers, and reduced environmental impact due to the small amount of oil required.

C-Lube is incorporated inside the slide unit, keeping size and weight to a minimum. Because C-Lube has no contact with the track, smooth motion is achieved without an increase in rolling resistance.

In addition, IKO designs and manufactures a wide range of crossed roller bearings that can handle radial, thrust and moment loads at the same time in compact sectional dimensions. These crossed roller bearings have rollers alternately crossed at right angles between inseparable inner and outer rings. Because the rollers in these bearings make line contact with the raceway surfaces, there’s minimal elastic deformation under load. Compared to ball type bearings, line contact of crossed roller bearings achieve higher dumping characteristics with zero or minimum preloading (T1) and more durability with anti-fretting feature under vibration of the machine.

For more information:

IKO International
Phone: (630) 766-6464
www.ikont.com

GKN Powder Metallurgy

BOOTH E-121602

Advanced CNC Press Technology

One of the greatest advantages of powder metal technology is the ability to create near net shape components. GKN’s Advanced CNC Press Technology provides the opportunity to reduce secondary operations and gives customers greater design flexibility for products.

The company leverages its internal tooling design and manufacturing capability to optimize the compaction process. With Advanced CNC Presses the boundaries for product design expands with high volume production at a lower cost.

Lightweight Technology

GKN also provides advanced aluminum lightweight technology with high thermal conductivity materials for structural and heat transfer applications.

GKN’s Aluminum Metal Matrix Composites (MMCs) create the

largest advantage for lightweight savings. What are Aluminum MMCs? GKN's Aluminum MMCs are designed with ceramic particles, equally dispersed within the aluminum alloy matrix, producing an aluminum alloy that improves static and dynamic performance.

The thermal properties and wear resistance of GKN's Aluminum MMC materials create efficiency savings. The material can perform for the strength needed in an application that die cast aluminum is unable to handle.

For more information:

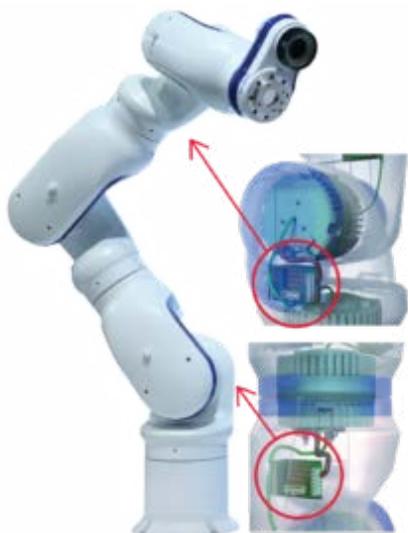
GKN Powder Metallurgy
Phone: (248) 270-6773
www.gkn.com

Elmo Motion Control

BOOTH E-134142

Elmo Motion Control, a provider of advanced motion solutions designed to make smart machines smarter for more than 30 years, offers intelligent, ultra-small, rugged servo drives and motion controllers. Elmo provides motion solutions for some of the most demanding applications in the world. Elmo's ultra-small drives and multi-axis controllers enhance overall accuracy, speed, and ensure fast, real-time responses of any application, improve throughput, and is known to give a competitive edge.

Elmo Motion Control's high-density servo drive, the Gold Twitter, has won the Technical Innovation of the Year



at the 2018 Motion Control Industry Awards. Ideal for high performance in limited space, the Gold Twitter drive weighs less than 0.7oz and measures the size of a postage stamp, yet can deliver over 5,500W of continuous qualitative power. Now the new version provides 10,000W.

Elmo's smart motion control technology is playing a key role in enabling the digital transformation in the smart industrial revolution — IR4.0. Mounted at the heart of machines,

intelligent, compact and decentralized servo drives act as advanced telemetry devices that can sense, monitor, and react accordingly. This smart servo technology not only leads to the very results promoted by Smart Industry, but also helps create leaner machinery that is smarter, smaller, lighter, faster, safer, greener, more efficient and also cost effective.

At the core of all dynamic and mobile robotic applications is the ability to move about with motion that is

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Right Angle Worm Gearboxes



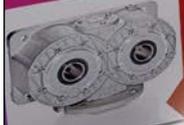
Bevel Gearboxes



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Shaft Mounted Helical Gearboxes





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precise, smooth, and above all safe. As more and more small to medium sized companies are entering the realm of robotics, innovative motion implementation tools are expected to simplify set-up, reduce time-to-market, and improve overall performance. The impact of Elmo's advanced servo technology goes beyond the actualization of motion, with considerable effects on footprint, efficiency, and safety.

For more information:

Elmo Motion Control, Inc.
Phone: (603) 821-9979
www.elmomc.com

Bega Special Tools

BOOTH: E-12144

Bega Special Tools will present the latest tools for easy and safe installation and removal of bearings and other transmission parts including the Betex MF Quick-Heater, a multifunctional frequency induction heater for both mounting and dismounting bearings and other machine parts. There is no limit to size or shape of the compo-



nents as the heater works with fixed or flexible hose-type inductors. The MF Quick-Heater generator is compact and easy to move around. It is clean and operates very quietly. Heating cycles can be stored on a computer, generators can be linked to work together. This method saves valuable time as it can be deployed very rapidly, needs fewer actions and can heat faster than conventional methods.

Besides the Betex MF Quick-Heater, the offering includes heaters, hydraulic pullers, pumps, cylinders and jacks. Betex heaters for mounting are designed for industrial use. They have a robust design, are ergonomic and

maintenance free. Betex hydraulic industrial pullers have a capacity from 4 to 150 tons. They are known for their unique design with integrated pump and cylinder, self-centering arms and jaw construction, providing safety and user convenience. Betex industrial hydraulic equipment such as pumps, cylinders and jacks up to 700 bar are compatible with major international brands.

"Products of our Betex brand are used all over the world by engineers involved in maintenance and production," says Richard Imbro, Bega's national sales manager for the USA. "All tools and methods have one thing in common: they are designed to make the job easier, faster and above all safer."

"If you are involved in machine maintenance then you know the importance of having the right tools for the right job," Imbro says. "Make sure you plan your visit to our booth to see and get a feel of our special tools for mounting and dismounting bearings and other transmission parts. This year we will have a bigger booth to show and demonstrate how our tools differ from other standard tools."

For more information:

Bega Special Tools
Phone: (516) 737-8012
www.begaspecialtools.com

Igus

BOOTH E-134521

Igus will showcase the world's fastest harnessed e-chain, fail-safe cables with three-year guarantees and maintenance-free bearing technology that can produce a 40 percent cost savings and other products during the International Manufacturing Technology Show in Chicago. Igus will focus on 10 trends for modernizing and protecting machines at IMTS. They are:

- Ready-to-install complete systems
- Chip protection for cables
- Lean Assembly; easy installation
- Energy efficiency on long travel distances
- Energy supply for rotary motions
- Industry 4.0 with smart plastics
- Failsafe cables with warranty
- Low-cost automation and robotics

- Lubrication and maintenance-free bearing technology
- 3D printing of wearing parts

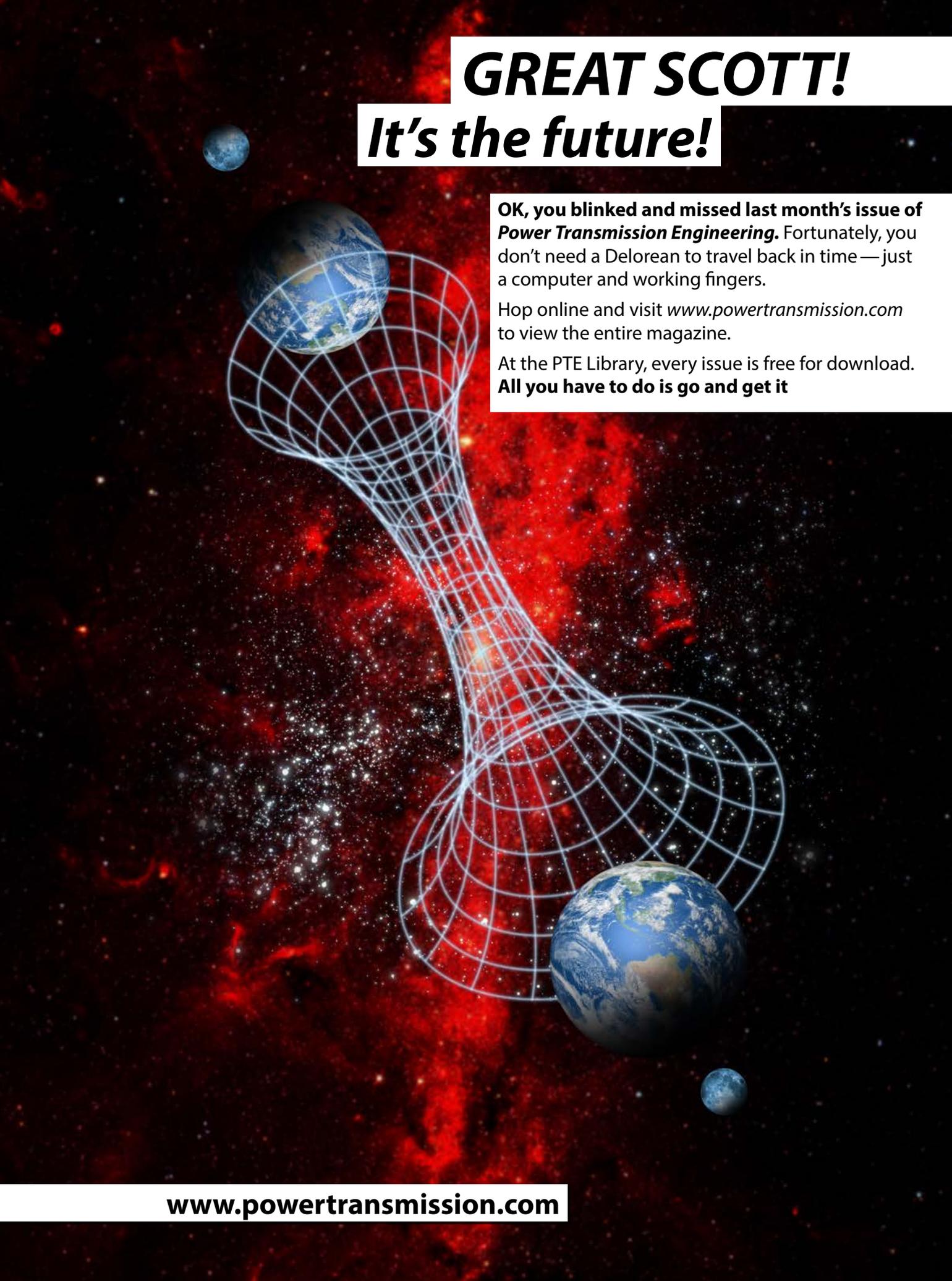
Among the products is Igus' new E4.1L energy chain, which is 50 percent lighter and requires 80 percent less assembly time than previous models. The e-chain also saves 95 percent on harnessing time and includes a honeycomb strain relief block that is simple, fast and flexible. It also includes separators for quick installation and for multi-level cable outlets.



The E4-1L is a general purpose e-chain with high dynamics. All of Igus' E4-1 system chains offer long service life, high stability and ease of installation and modularity. Among other products the company will also be displaying are items from its smart plastics line, which use data to predict their replacement date during operation; highly flexible cables that come with a 3-year guarantee; plain and hybrid bearings and its robotlink modular kit, which helps people build or buy cost-effective robots. **PTE**

For more information:

Igus, Inc.
Phone: (800) 521-2747
www.igus.com

A wireframe wormhole structure is depicted against a cosmic background of stars and a red nebula. The wormhole is a funnel shape that narrows in the center. At the top opening of the wormhole, a full Earth is visible. At the bottom opening, another full Earth is shown. Two smaller, blue and white spheres, resembling moons or smaller planets, are positioned in the upper left and lower right corners of the frame. The overall scene suggests a journey through time or space.

GREAT SCOTT!

It's the future!

OK, you blinked and missed last month's issue of *Power Transmission Engineering*. Fortunately, you don't need a DeLorean to travel back in time — just a computer and working fingers.

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PTE features three blogs to keep readers updated on the latest PT trends, technologies and industry solutions:

Bearings with Norm: Norm Parker is Global Senior Specialist – Roller Bearings at FCA US LLC and offers various insights and technical knowledge on the bearing industry.

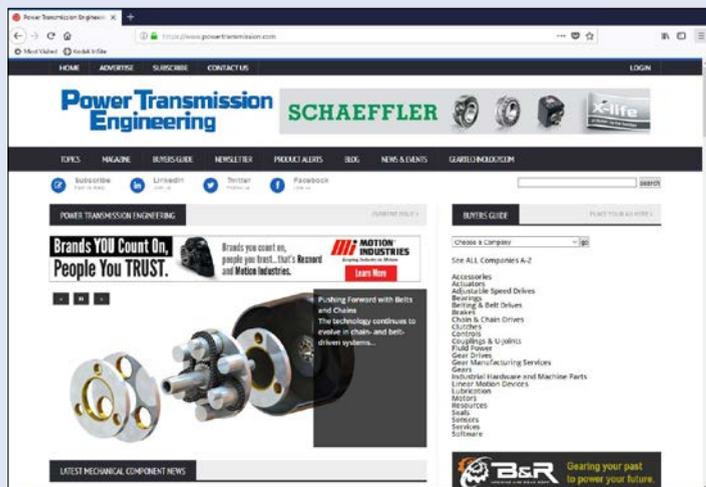
Motor Matters with George Holling: The technical director at Rocky Mountain Technologies regularly contributes articles regarding motors, power quality, power factor, efficiency and more.

Editor's Choice: Our editorial staff provides relevant and timely articles on a variety of PT industrial topics.

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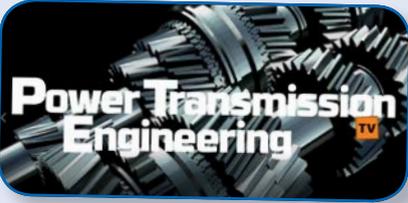


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Set It and Forget It

Pneumatics Ensures Reliability in Packaging Application

Xavier van Aelst, director food and beverage, Aventics

Machines for filling milk or juice must work around the clock. With an output of up to 12,000 cartons an hour, disruptions and down-time are not at all welcome. For this reason, availability plays a major role in selecting machine components. Elopak's motto here is "set it then forget it." Their E-PS120A is the first fully aseptic filling machine for gable top packaging. This efficient, powerful solution presented by the packaging specialist ensures high reliability owing in part to robust, food-compliant pneumatics from Aventics.

"The latest technical features are not our main concern when selecting components," said Wolfgang Buchkremer, senior manager research and engineering at Elopak EQS GmbH in Mönchengladbach (Norway.) "We need components that play their part without standing out - we want to be able to install and then forget them. And that isn't possible with just any component."

In developing its fully aseptic gable top system, Elopak is pursuing its strategy of ultra-functional packaging concepts. The Pure-Pak Advanced filling concept meets both increasing expectations of consumers regarding product design, functionality and quality, and industry requirements regarding maximum efficiency and machine availability.

The E-PS120A aseptic filling machine offers top-class automation technology and is divided into six modules. The inserted packaging material is recorded, set upright, and pre-folded. The sealing cap is then applied via ultrasound welding and the bottom is heated and pressed to seal the carton. In a separate chamber, the packaging is sterilized with hydrogen peroxide, and the product is then filled with a single shot. Finally, the packaging is induction-welded and transported out of the machine.

With this system, users can choose from three packaging sizes of 500 ml, 750 ml, and 1 L. Since all machine processes are geared to the packaging height, the only adjustment required to switch between them is the height of the bottom of the carton. Performed by a cylinder, this movement takes just a few minutes and provides a major advantage compared to competitor machines.

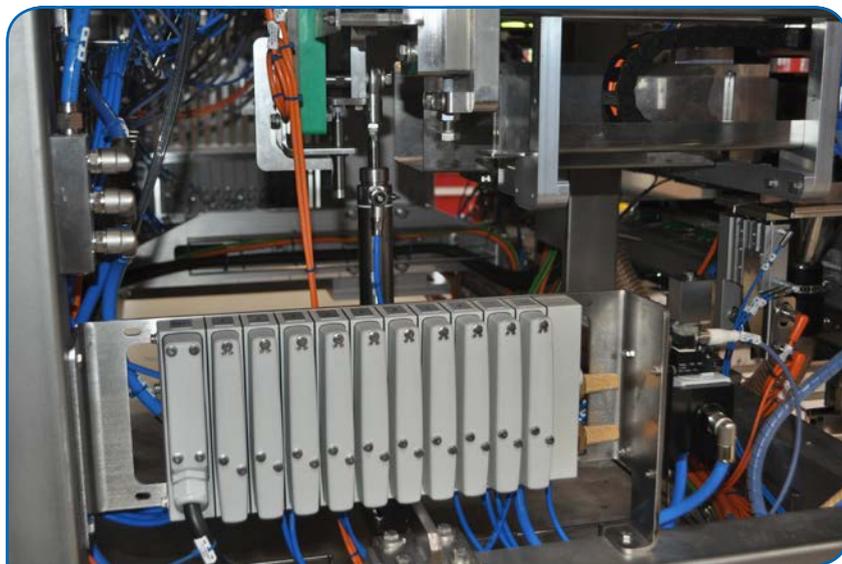
The design and construction of such a modern filling machine are complex tasks. A sterile environment and aseptic packaging are vital to maintain product quality for the long term at room temperature without cooling the products or using other methods. This means the ultra-sensitive drinks, dairy products, and liquid foods have to be filled

hygienically and securely while the machine components are subjected to extreme environmental conditions such as cold, humidity and splashes.

Elopak owes its success to technical expertise and decades of experience.

"Frequently, permanent reliability comes down to the details," emphasizes Buchkremer, referring to the close collaboration with Aventics: "Even though the pneumatic components installed here at first appear insignificant, they are crucial to machine availability and aseptics. In addition to reliable components, we also need close contact and collaboration with suppliers based on partnership to detect optimization potentials in good time and drive improvements forward together."

An Aventics SSI series compact cylinder isolates sealing caps by moving them from one side to another. It sounds like a simple task, but it has to function precisely, around one million times a week in day-to-day operations. Based on



The Aventics HF03 series valve system is used in many Elopak machines.

concrete application data supplied by Elopak, the cylinder experts at Aventics reinforced the piston package, extending the cylinder's service life, which in turn has a positive effect on machine availability. Other cylinders move packaging forward up to the next processing step. Pressure varies depending on the position and amount of packaging on a rail. Here, the ED02 electropneumatic pressure regulator ensures precise, dynamically controlled pressure, enabling an optimized, energy-efficient process.

In addition, hydrogen peroxide (H₂O₂) is used to sterilize the packaging, but has an effect on all reactive components,

including sealing materials and grease, which are standard for throttles. Here, choosing the wrong material poses a risk to the entire sterilization process in the long run.

“We worked with Aventics to find a suitable solution, and now use a throttle that has been cleaned on the inside, with a special sealing ring on the sterilization system’s vaporizer. These design details allow us to achieve higher stabil-



Depending on the requirement, Elopak combines shut-off and ventilation valves to create the perfect solution, optimizing the compressed air system’s energy efficiency. Compressed air treatment steps such as filtering, regulating, and dehydrating are already integrated in the AS maintenance units from Aventics and ensure high compressed air quality.

ity,” states Johannes Platen, responsible for engineering and mechanical design at Elopak EQS.

HO-impregnated air also resulted in an application-specific development here. To extend the valves’ service life, valve specialists at Aventics combined a standard valve system with an aluminum corner strip including an all-round seal. Now, the valve pilots engage directly in the closed cable conduit within the machine, while the outlets exit the machine. This effectively prevents problematic contact between valves and hydrogen peroxide, contributing to optimized reliability.

The special unit consists of three Aventics components mainly aiming for machine safety to meet the required performance level. Combined with a soft-start and a blocking valve, an AS series maintenance unit offers an array of functions. After a safety cut-out and when the system is depressurized, for example by opening the doors, the valve systems should not be subjected to the full 6 bars of pressure immediately upon restart. The application-specific design now ensures the valve systems are slowly filled with compressed air.

Hygienic safety for series production

Aventics realizes such detailed solutions thanks to its many years of experience in designing hygienic components. This is reflected in numerous properties of the ‘best-in-class’ components customized specifically for utmost food safety. In plain terms, this means no recesses or sharp edges, easy cleaning and disinfection as well as the use of food-compliant materials and lubricants, and resistance to chemicals.

“Aventics provided Elopak EQS with support right from the start and knows what it means to monitor a near-series machine in development. The pneumatic components made a major contribution in the reliability and low-maintenance requirements of our innovative aseptic filling machine, not least for these reasons. This all boosts machine availability,” said Buchkremer. “Furthermore, Aventics and Elopak support the VDMA initiative to standardize consumption measurement so we are on the same level when it comes to determining energy efficiency, able to implement this together to the user’s advantage.”

Elopak will also use the Aventics Advanced Valve series, which is optimized for future requirements for continuous data exchange from the control to the lowest field level. “This meets our desire to continue driving fieldbus technology forward, also in pneumatics,” says Platen, adding: “This development, too, will be

realized in close collaboration with Aventics.” **PTE**

For more information:

Aventics (Emerson Automation Solutions)
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www.aventics.com

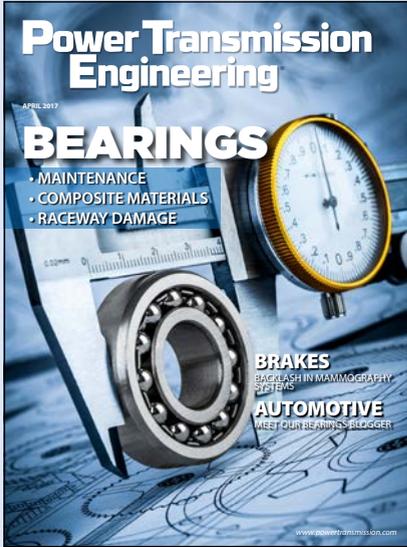
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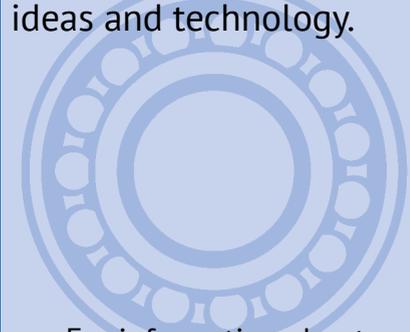
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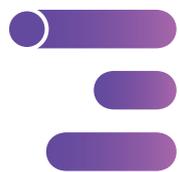
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The Clean Cut

JBT Corporation Benefits from Kollmorgen Hygienic Motor Design in Food & Beverage Application

Matthew Jaster, Senior Editor

JBT Corporation has been producing food industry machinery since the 1880s. The current JBT portfolio includes slicing, waterjet cutting, and sorting systems to meet portioning and trimming needs. The company's DSI Portioning Systems generate portions, nuggets, chunks, strips, fat-trimmed, and fat-free products efficiently and accurately.

The product is loaded on a conveyor and scanned with an automated vision system that determines key attributes for each piece. *DSI* software selects a cut strategy that maximizes yield for each piece, and cutting takes place via a horizontal slicer blade or a vertical ultra-thin stream of high-pressure water. If you compare this to manual portioning in the food and beverage industry, a small staff can replace dozens of laborers with knives and scissors.

Expanding upon the success of their DSI Portioning Systems, JBT Corporation sought to develop a new blade portioner that would be easy-to-maintain, easy-to-clean and use less floor space while continuing to utilize both *DSI Q-LINK* software and *BladeSense* software technologies for yield optimization and blade condition monitoring.

The challenge was designing a compact, easy-to-clean portioning system, according to Jon Hocker, JBT Director of DSI and Global Product R&D.

"Most systems on the market had covers around the servomotors to protect from water spray during cleaning. These covers made sanitization a challenge. Eliminating these covers was essential to our JBT design intent and marketing message. For JBT it is imperative to improve the hygienic design in our new equipment to help customers maximize uptime and minimize food safety risk," Hocker said.

The result was the DSI DB20, an accurate, hygienic, easy-to-operate portioning system suitable for a wide range of linear portioning applications. Machine maintenance requirements are reduced significantly using self-aligning belts and software that suggests replacement blades at the optimal time.

In addition to reducing maintenance frequency, the system is designed for routine maintenance to occur quickly with conveyor belts or belt sections and blades designed to be safely replaced in a matter of minutes increasing machine uptime.

DSI DB20 Dual Blade Portioning System: a hygienic, high-yield, low-maintenance blade portioning system powered by proven DSI Q-LINK Portioning Software from JBT.

Collaboration Yields to Design Modifications

Along with the motor sizing and "co-engineering" (CoE) at the beginning of JBT's DSI DB20 Portioning System project, Kollmorgen and JBT worked closely throughout the evolution of the machine, according to Kevin Garrison, senior mechanical engineer and lead engineer for AKMH at Kollmorgen.

"This collaboration enabled several design modifications to be proposed on-site. Thereafter, the new design was implemented quickly and exceeded the performance of the original, further thanks to the great teamwork," Garrison said.

A key focus of the design was to prevent water ingress into the motors in extremely harsh washdown environments. Kollmorgen's knowledge in sealing, and shaft design was critical to ensure the durability of the motors.

Servo Performance Upgrades

One of the highlights of the design was the application of the Kollmorgen AKMH IP69K servomotors directly coupled to the blades. This allowed for a compact yet open design of the cutting compartment.

The AKMH servomotors deliver the necessary servo performance and are durable enough to be applied without the bulky motor covers that complicate cleaning and maintenance procedures and add to machine size.

AKMH stainless steel servomotors can be cleaned with solutions ranging from 2 to 12 pH and high pressure spray up to 1,450 psi, allowing them to be cleaned just like the rest of the machine and hence save valuable time.

Kollmorgen's AKMH motors are designed with a smooth surface finish, laser annealed nameplate, no external fasteners, no metal to metal seams, no flat surfaces and no nooks and crannies leaving no place for pathogens or food to hide.

"These motors reliably survive direct spray from sanitation personnel, eliminating the troublesome housing and





Close-up of the Dual Blade Portioning System from JBT.

ventilation systems present on other blade portioners,” Hocker said.

He was also surprised by some of the additional AKMH servomotor capabilities:

“Some very specific applications generate significant heat in any servo solution. We realized we could liquid cool these motors with mist nozzles for the rare occasion when needed. What surprised us was how effective the liquid cooling was. We can significantly outperform competitors on specific applications because when other systems overheat or have to be slowed to manage heat, our solution can run continuously at higher capacity,” Hocker said.

In addition to the motors, the machine is designed with ample lighting and open surfaces for inspection and cleaning and low profile removable trays for easy collection and clean-up of any minor cutting debris. The DB20 portioner can operate at belt speeds up to 100 feet per minute and perform up to 2,200 cuts per minute, increasing production rates.

Digital Manufacturing Advantages

Hocker said that washdown robots have been making progress in the food & beverage industry. Components such as gaskets, shaft seals and cord grips must meet hygienic and durability standards. Kollmorgen’s AKMH motors have good solutions in these areas.

“Value-creating secure connectivity is a vital capability as we look forward,” Hocker said. “The JBT iOPS System securely connects to and stores our customer’s product, process and equipment data. We are now providing predictive maintenance and process optimization with the JBT iOPS system. We also gather useful information from the Kollmorgen servo system.”

Garrison agrees that maintenance through IoT and Industry 4.0 is within reach.

“Active output monitoring of the AKMH motor can be an indicator of the health and condition of the motor and provide triggers for when service needs to intervene in advance of a line shutdown. Our modular based product design means that the AKMH servomotor, combined with the Kollmorgen AKD drive, is ready to move with the market as IoT advances,” he said.

Preventative maintenance for AKMH servos is done using the servo drive which monitors parameters such as current.

“As IoT continues to gain traction, we expect to see even more tools for preventative maintenance to appear in all Kollmorgen products,” Garrison added.

An Evolving Partnership

Kollmorgen looks at two important criteria when dealing with a food and beverage production facilities:

Limit machine downtime to expected, preventative maintenance (PM) cycles.

Reduce downtime required for cleaning cycles.

Garrison believes the AKMH is purposely-engineered for durability and performance in the most challenging conditions. It is designed to reduce the amount of downtime required for cleaning cycles by making it easier to clean a system and eliminating additional steps in the cleaning process.

Hocker plans to take advantage of these servomotors moving forward.

“We plan to use this product in different sizes and applications and look forward to future products as well,” Hocker said. **PTE**

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Food & Beverage Industry Product Round-Up

The following contains additional products recently released for food and beverage applications including drives, chains and fittings.

Iwis

OFFERS PIN OVEN CHAINS FOR THE BEVERAGE CAN INDUSTRY

Cans are still the classic packaging choice for drinks in the food and beverage industry. After forming, one of the next high-speed production processes the cans undergo is painting. Specially-developed roller chains have become the preferred conveying technology for this rapid transfer, during which the cans are held in place by protective heads connected to the chain by special transport pins.



The pin oven chains (POC) developed by iwis offer a number of unique advantages. The precision roller chains themselves are particularly wear-resistant and they are treated with the Iwis special lubricant IPP before they leave the factory. IPP is PWIS-free, non-drip, suitable for high temperatures and approved for use in the food industry.

Transport pins can be replaced easily without breaking the chain or removing it from the machine. Three different fixture possibilities are available - pins are integrated in the outer chain plates, secured with special nuts or fixed with split-pins. Users can also choose between two pin versions: flexible or snap-off. The flexible pin - for example after an accidental impact caused by a conveyor jam - can be quickly and easily bent back to its originally position by hand.

The advantage of the snap-off pin is that it will break off in the event of a shock or accidental contact with an obstacle during operation. The snap-off solution is possible because both transport pins and chain pins have the hardness and thus the same wear resistance. This can be of importance when producing steel cans with a risk of jamming the production machines, when the pins do not break. The length of the transport pins can also be adapted to the requirements of individual specifications.

Finally, the standard protective head is made from high-quality PEEK which is heatproof up to at least 260 °C and is resistant to a variety of chemicals. A high-temperature elastomer head (ECT) developed and patented by iwis is also available as an alternative. With its design, it can be replaced easily without the need for complex tools and it is robust in

everyday operation because its damping properties are similar to those of a spring. It is made from PWIS-free material that is approved for use in contact with food.

Well-equipped in every respect: a comprehensive range of spare parts and user-friendly tools for assembling and dismantling chains round off the Iwis pin oven chain program.

Iwis is always able to offer can manufacturers a high-quality conveyor chain solution that is tailor-made for their individual application requirements. The hallmark of quality: all production series use JWIS brand precision roller chains, so long service life and reliable aftersales service are guaranteed.

In addition to pin oven chains, Munich-based chain specialist Iwis provides a full product range for all drive and conveying applications. This also includes precision and high-performance roller chains, conveyor chains, maintenance-free and corrosion-resistant chains, power and free conveyor chains, special-purpose conveyor chains, flyer chains, flat-top chains, modular belts, chains and accessories for agricultural machinery, and timing drives for the automotive industry.

For more information:

Iwis Drive Systems, LLC
Phone: (317) 821-3539
www.iwisusa.com

Emerson

EXPANDS LINE OF LIQUIDTIGHT CONDUIT FITTINGS

Emerson is targeting the food, beverage and pharmaceutical industries with its 4QSS liquidtight fittings featuring 316 stainless steel for dependable performance that will last decades in wet, corrosive locations.



Engineered for applications where sanitation is a critical concern and washdowns are frequent, the UL Listed fittings securely connect flexible metallic electrical conduit while completely sealing off liquids, vapors and solids. A nickel-plated ferrule provides maximum surface contact with longer, more pronounced threads; this ensures pull-out

protection and the prevention of tight bend conduit “pop-out” to help minimize costly replacements and service calls.

As a result of high demand by users in a variety of industries, 4QSS fittings are available in a broad range of trade sizes of 3/8-inch to 2-inches, with body designs of straight, 45° and 90°.

Thanks to their compact, slim profile the fittings allow for a tighter turning radius for installation in standard knock-out spacing, a common user frustration with standard fittings.

In addition to sanitary environments 4QSS fittings are well suited for machine tool building, HVAC, robotics assembly and areas rated hazardous by the NEC such as petrochemical processing.

For more information:

Emerson Industrial Automation
Phone: (314) 553-2000
www.emerson.com

Nord Drivesystems

OFFERS ALUMINUM DRIVE UNITS FOR FOOD & BEVERAGE APPLICATIONS

Earlier this year, Nord Drivesystems released aluminum drive units for the food and beverage industry. The lightweight, corrosion-resistant gear units, smooth surface motors, frequency inverters and motor starters in washdown optimized die cast aluminum housings are extremely robust and durable thanks to a special surface treatment: Nord nsd tupH surface protection.



With this process, the material is hardened below the surface. The surface treatment creates a protective layer which is permanently bonded to the substrate material. It is based on an electrolytic process and gives aluminum corrosion resistance properties which are similar to those of stainless steel. The scratch-resistant surface is more than seven times harder than untreated aluminum alloy. The drives can easily withstand high pressure steam washing or contact with aggressive media.

Among other applications, Nord nsd tupH modules are used in the many conveyor systems which are used in oyster farming. While cast iron geared motors only remain operational for one or two years due to corrosion by the salty environment, the aluminum drive units from Northern Germany

offer a durable and economical solution, which usually completely outlives the 10 year life cycle of the conveyor belts which they drive. Therefore, users save time and expense for the maintenance and repair of their systems.

These drive units are a robust, durable and economical alternative to painted cast iron geared motors or stainless steel versions. The nsd tupH treatment is available for all Nord aluminum products, unlike stainless steel drives, which are only offered in a small number of versions by other manufacturers.

For nsd tupH aluminium drive units, all DIN and standard components, including drive shafts, are made from stainless steel. The fan-less smooth motors do not spread germs and also run very quietly. They are available as synchronous and asynchronous motors and fulfil efficiency classes IE2 and IE3 (asynchronous motors) and IE4 (synchronous motors).

For more information:

Nord Drivesystems
Phone: (608) 849-7300
www.nord.com

Tsubaki

OFFERS CHAIN PRODUCTS FOR GLOBAL FOOD INDUSTRY

Tsubaki has developed a number of engineered chain solutions which provide for the precise hygiene requirements of both food processing and packaging; while also offering minimal wear, reduced maintenance and increased productivity.

The latest generation of Tsubaki’s lube-free RS Lambda chain is particularly suited for conveyor applications where the product may be at risk of contamination from contact with the chain. The design incorporates internally lubricated sintered bushes, the pores of which are vacuum filled with NSF-H1 food grade lubricant. The chain runs ‘dry to the touch’ and requires no additional lubrication throughout its life, yet provides a significant increase in wear-life performance.

Tsubaki has developed the Lambda concept a stage further to specialize it for retrofitting to tray packaging machinery widely used in the food and beverage industry. On such



Lambda
ADVANCED LUBE FREE CHAIN

Tsubaki
ECO LINK

machines, where cleanliness and hygiene are paramount, standard lubricated chain can cause contamination and may become chocked with dust and other particles, rendering the lubrication ineffective.

The Lambda chain has a consistent internal lubrication, it therefore combats the risks of uneven wear and elongation amongst the partner chains. Combined with Tsubaki's unique Match and Tag service, this delivers an unparalleled operating life for the application. Depending on the needs of the application the chain can be fitted with pushers or other attachments via an extended pin.

For washdown environments and other applications with harsh environments, the Neptune chain features high tensile strength and corrosion resistance. The chain benefits from a ground breaking, two-layer surface treatment that combines protection against corrosive environments with maximized chain strength. A top coat of resin protects against physical impact and corrosive agents, while a base coating prevents oxidization from reaching the chain. The coatings are applied prior to chain assembly to ensure that each component is completely coated, so that Neptune can be used in wet environments or even underwater.

Tsubaki prides itself on its ability to apply its engineering expertise to its customers' needs. Tsubaki can combine many of its technologies and design bespoke solutions that exceed the expectations of manufacturers within the food industry.

For more information:

Tsubaki
Phone: (800) 323-7790
www.ustsubaki.com

Winsmith

LAUNCHES RD SPEED REDUCER

The patent pending Winsmith RD is uniquely engineered to provide performance in applications involving general industrial processing and material handling equipment such as: food processing, bottling, and packaging. The RD offers offer a fret-free motor connection that guarantees quick motor removal and replacement.

The innovative single lubricant level design delivers off-the-shelf universal mounting capabilities. The RD is dimensionally interchangeable with many competitors' quill input right angle speed reducers, and its modular product assembly method ensures that most configurations can ship within 24 hours of order placement.



The RD provides superior operating performance by incorporating Winsmith's premium efficient gearing, a two-bearing worm support, and the WinGuard 316 stainless epoxy coating system; as well as standard product features.

In addition to the standard offering, Winsmith offers the RD Max, which features the addition of a stainless-steel nameplate and output shaft, IP66 certification, and x-ray and magnetically detectable food safety blue plugs.

For more information:

Winsmith
Phone: (716) 592-9310
www.winsmith.com

Brother

IPMAX GEARMOTORS OFFER COMPACT, LIGHTWEIGHT OPTION

Brother Gearmotors, a division of Brother International Corporation that offers a wide range of ultra-reliable, sub-fractional AC gearmotors and reducers for the food & beverage, packaging and material handling industries, has introduced IPMax, a line of lightweight, compact interior permanent magnet (IPM) gearmotors that are highly efficient with a wide synchronous speed range.

The series of IPMax maximum performance gearmotors incorporate magnets embedded within the rotor, as opposed to on the surface. No copper losses are experienced in the rotor, and considerably less copper losses occur in stator winding. The gearmotors can operate fanless up to 1hp, and do not require encoders for sensor control. When stopped, a servo lock feature holds the motor in position.



Brother's IPMax gearmotors are 23% smaller than comparable ie3 motors, and run 24% cooler for longer lifespan. They employ brake sequential - which sets motor operations when the mechanical brake is turned on or off - as well as a torque limit solution that protects the mechanical system. Various functions of their programmable I/O terminals may be changed according to external circuits or applications. RS485 is included as standard. **PTE**

For more information:

Brother Gearmotors
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Power Transmission Engineering

Electrical Stress and Parasitic Currents in Machine Elements of Drivetrains with Voltage Source Inverters

Alexander Furtmann and Gerhard Poll

Introduction

Modern drivetrains with voltage-source inverters not only offer advantages like, for example, variable speed operation, increased efficiency and higher dynamics—but also an increase in failures caused by induced parasitic currents. One of these currents, the so called EDM current, is known for damaging bearing raceways and lubricant, thus leading to a reduced lifetime. EDM currents occur if the voltage across a lubricant film is too high and the maximum dielectric strength in the contact is exceeded. The source of the voltage is what is known as “common-mode” voltage, which is inherent in voltage source inverters with two discrete switching states. While the behavior of electric motors has been vigorously investigated in recent years (Refs. 2-6), the effects of parasitic currents on the whole drivetrain have yet to be a focus of research. Damage on tooth flanks and gearbox bearings due to parasitic currents are also known.

Regarding EDM currents, the electrical capacitances of a system are its most important parameter. In a drivetrain, all machine elements with a separating lubricant film—e.g., rolling element bearings, journal bearings and gears—behave like an electrical capacitor whose capacitance depends on contact conditions like film-thickness and contact area, but also on the lubricant that acts as the dielectric. Further attention is required for the gear mesh, as a lot of the contact parameters vary over the path of contact (Ref. 1).

Basics

Electrical stress due to inverter-induced, parasitic currents can be traced back to two root effects, according to Mütze (Ref. 3). These effects are high-frequency ground currents generated by the fast switching of the inverter and the so called common-mode voltage, with the latter being responsible for EDM currents. Due to the fact that voltage-source converters only have discrete switching states, the sum of the three output voltages, in contrast to a sinusoidal supply, is not equal to zero. As a result, a voltage that is proportional to the common-mode voltage occurs at the motor bearings as the parasitic capacitances in the system form a capacitance voltage divider. If the voltage over the lubricant film exceeds the dielectric strength of the lubricant, a break-

down and thus an EDM current (electric discharge machining) occurs. Due to the high energy in such a discharge, the lubricant may be negatively affected and the metal surfaces can melt. Very high, energetic discharges can also vaporize parts of the surface, which was shown to be very harmful in regards to creating fluting in bearings (Ref.7). For a better understanding and a prediction of EDM currents, it is important to know the amplitude of the voltage at the different machine elements. To calculate the voltages in an electric motor, equivalent circuits based on capacitors were developed (for example, by Hausberg or Mütze). These networks consist of the capacitance between rotor and frame C_{rf} , winding and frame C_{wf} , winding and rotor C_{wr} and the

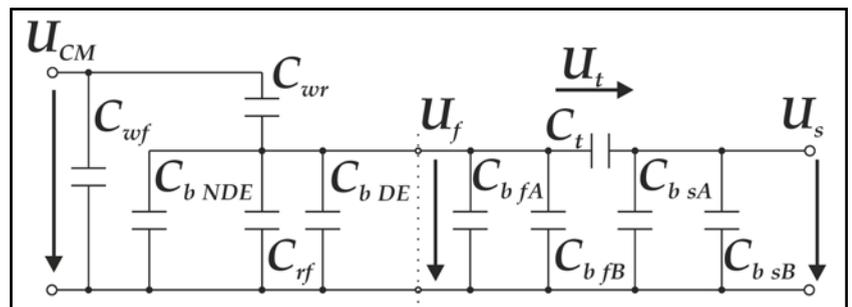


Figure 1 Combined equivalent circuit for a drivetrain consisting of a motor and a single-stage gearbox (fast-shaft with index f, slow shaft with index s).

bearing capacitances C_b . Recent research expanded this network to the gearbox behavior. Using the example of a single-staged gearbox, Figure 1 gives the combined equivalent circuit of motor and gearbox combination. For the gearbox, the tooth capacitance over the gear mesh C_t was introduced. This capacitance is not constant for one operation point, as it is changing due to the movement of the teeth (Refs. 1, 8-9).

As shown (Ref. 8), the voltage divider of the common-mode voltage U_{CM} to the voltage U_f at the fast-shaft, and the one to the voltage U_s at the slow-shaft, can be determined with Equations 1 and 2:

$$BVR^* = \frac{U_f}{U_{CM}} = \frac{C_{wr}}{C_{wr} + C_{rf} + C_{bDE} + C_{bNDE} + C_{bfA} + C_{bfB} + \frac{C_t \cdot (C_{bsA} + C_{bsB})}{C_t + C_{bsA} + C_{bsB}}} \quad (1)$$

$$BVR_{Drivetrain} = \frac{U_f}{U_{CM}} = GVR \cdot BVR^* = \frac{C_t}{C_{bsA} + C_{bsB} + C_t} \cdot BVR^* \quad (2)$$

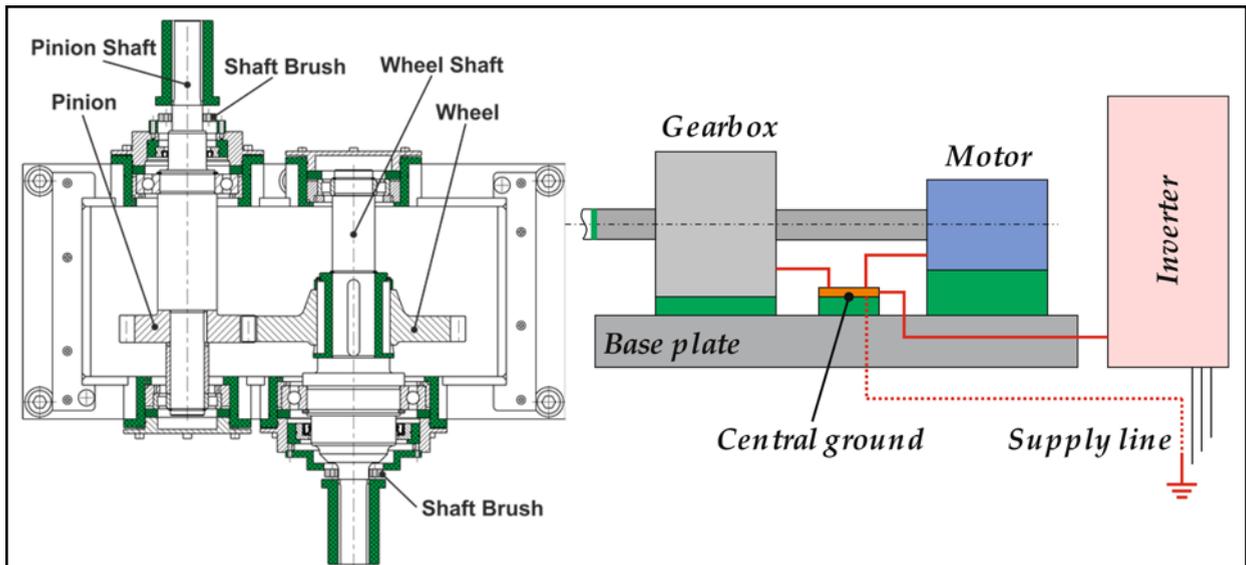


Figure 2 Gearbox with insulations (left) and grounding concept of the drivetrain (right).

Experimental set-up. To measure the currents and voltages in the drivetrain, a special test rig was designed and built. The system was designed as an electrical back-to-back test rig to with a frequency-controlled motor and generator on the slow and fast side of a single-staged gearbox. In an unprepared system, it is not possible to determine the current paths exactly due to the large contact areas of the different machine elements. A way around this problem was found by insulating the elements from each other and then setting up defined bridges for the insulation. Through these bridges the whole current of a component has to flow, and thus it is an easy spot for measurements. While the insulation of the gearbox and motor housings from the frame can be achieved quite easily with large plastic plates, the insulation of single machine elements requires more effort. For the drive unit a motor with insulated bearing shields was used. This motor was already used in the research by Hausberg (Ref.2). The driven machine was insulated from the gearbox by the use of an insulated coupling. For the gearbox a modified gearbox as shown in (Ref. 1) was used. Figure 2 (left) shows the gearbox with insulations between the bearings and the housing. As the current over the gear mesh is not directly measurable due to the non-stationary parts, it can only be observed by measuring all other currents and then deriving the gear mesh currents. In Figure 2 (right) and Figure 3, all the necessary measuring points and the defined ground system are depicted.

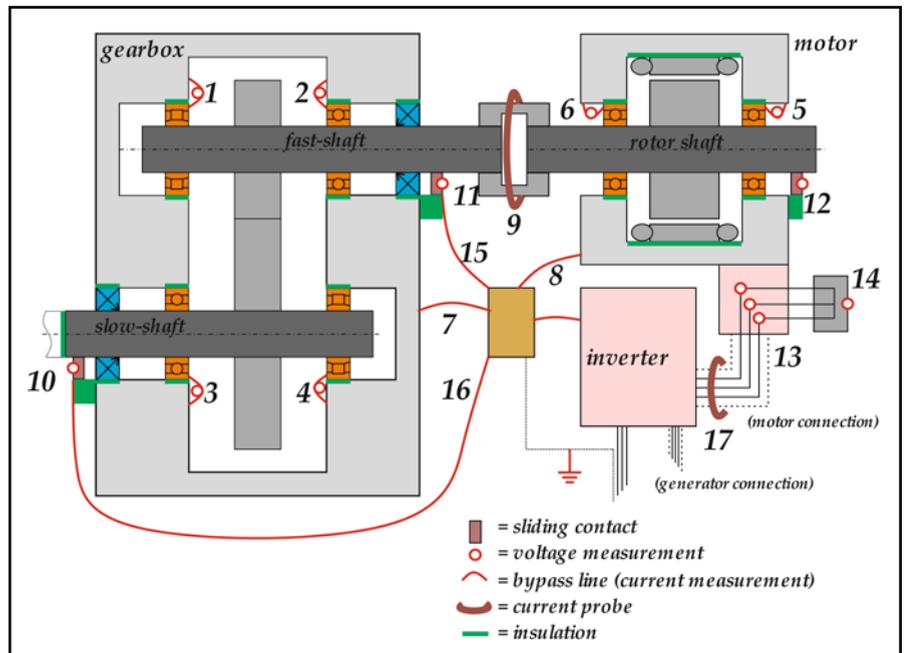


Figure 3 Drivetrain with multiple measuring points.

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Due to the high-frequency nature of the parasitic currents, it was necessary to use probes and scopes that are suited for such frequencies. For the measurements two 4-channel oscilloscopes Tektronix MDO4054C with a bandwidth of 500 MHz and a sampling rate of 2.5 GS/s were used in a master-slave arrangement (Fig. 4, left) to enable simultaneous triggering at specific conditions like a breakdown in a defined bearing. The bearing currents were measured with current probes Pearson Model 6595 (Fig. 4, right) and the voltages with differential voltage probes Tektronix TMDP0200. To avoid needing three voltage channels for the common-mode voltage, an artificial neutral point by Yokogawa was used.

Results

First measurements were done to evaluate the predicted behavior of the gearbox as a voltage divider. Therefore the com-

mon-mode-voltage U_{CM} , the shaft voltages U_f and U_s , and the voltage over the gear mesh were measured. Figures 5 and 6 show the behavior of the voltages for two different operation points. Figure 5 is a very good example for the voltage dividing behavior, as all voltages follow the common-mode voltage with a reduced amplitude. The amplitude of the voltage is also further reduced along the gearbox, as was predicted by the model. Furthermore it can be seen that the voltage of the slow shaft and the voltage over the gear mesh match the voltage of the fast shaft. Contrary to this behavior, Figure 6 shows something else—over the measurement almost no voltage is built up at the slow shaft, while the fast shaft voltage and the gear mesh voltage are the same. This shows that at these conditions the slow shaft bearings have no separating lubricant film and thus behave like a direct ground connection. As a result the gear mesh and the fast shaft bear-

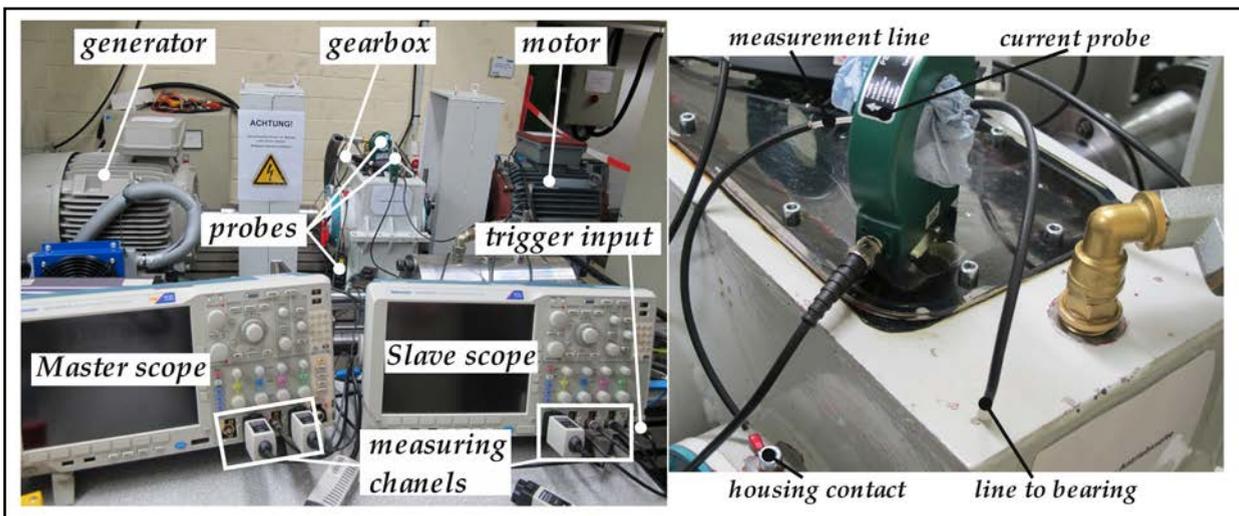


Figure 4 Measurement setup with two oscilloscopes in a master-slave arrangement (left) and current probe for measuring bearing currents (right).

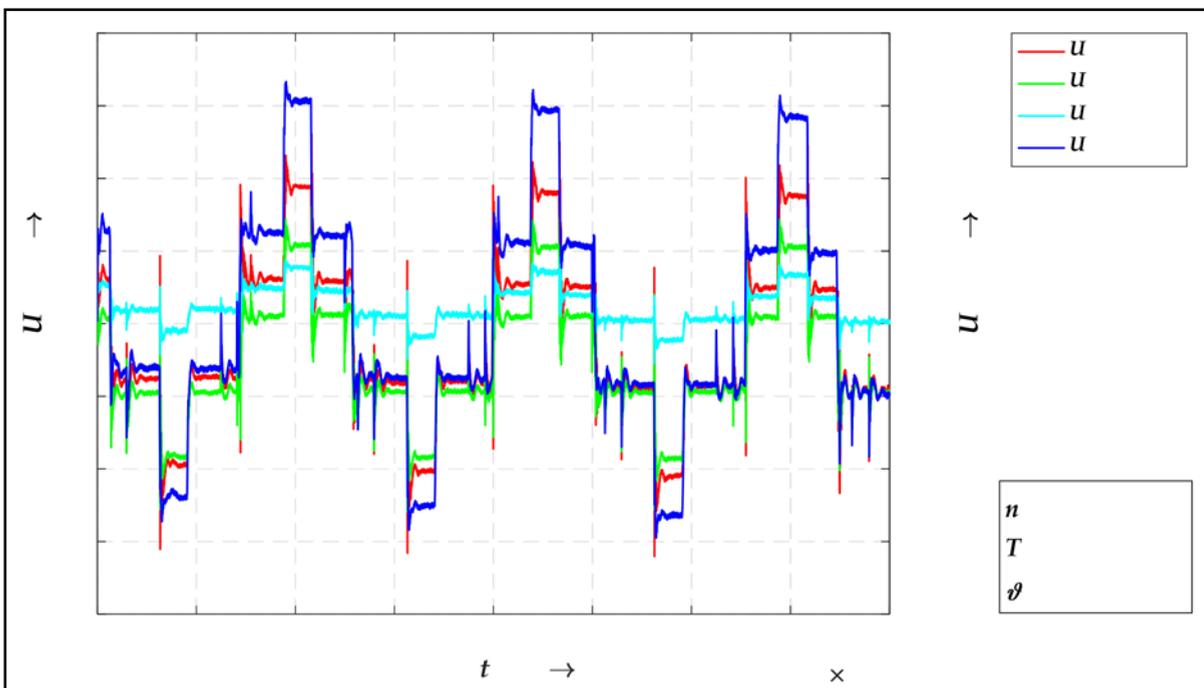


Figure 5 Measured voltages in the drivetrain with a clearly visible voltage divider.

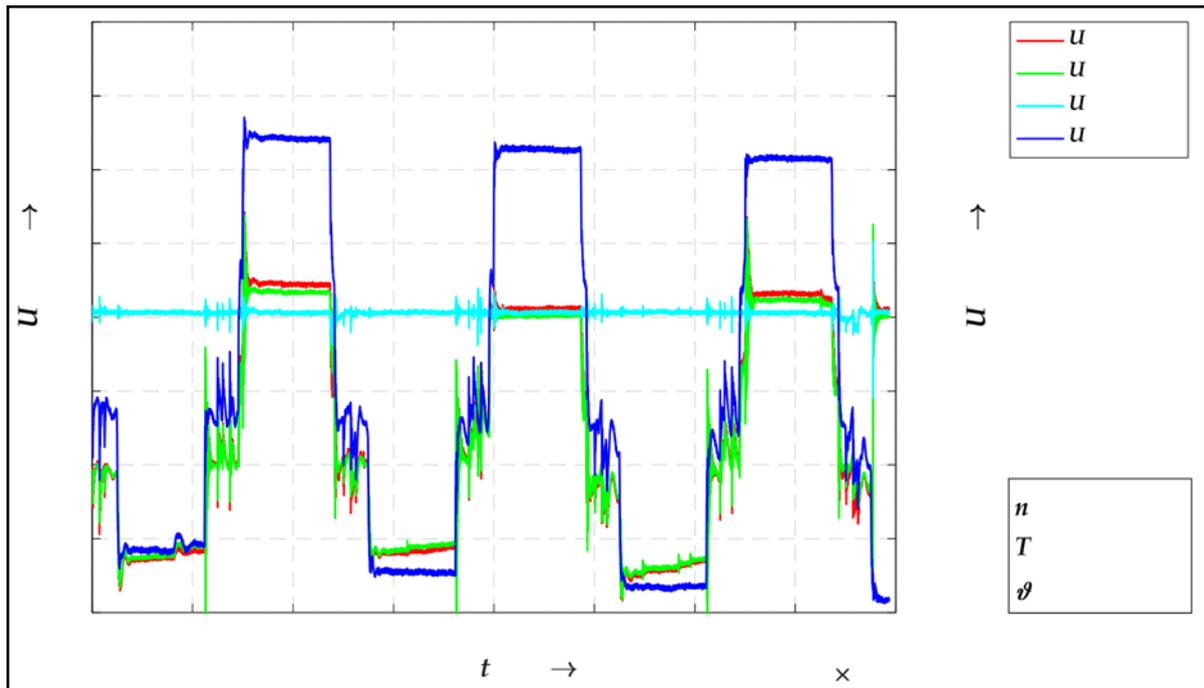


Figure 6 Measured voltages in the drivetrain with no voltage at the slow-shaft due to mixed lubrication.

ings are in a direct loop and therefore must have the same voltage. The measurements also confirm the non-constant behavior of the gear mesh capacitance. While the common-mode voltage remains constant in one step, the voltage in the loop of fast shaft and gear mesh is varying and thus the capacitance of this loop also has to be changing.

To compare the voltage dividing behavior, a simulation of the drive train with calculated capacitances (Refs. 1, 8-9) is done based on a measurement of the common-mode voltage. In this simulation the breakdown voltage is set to large values so that there is no negative influence of discharge events on the curve shape. This was not possible for the

	measurement	simulation $C_{t,min}$	simulation $C_{t,max}$
BVR⁺	3.164%	2.76%	2.8%
GVR	29.7%	36.7%	27.9%
BVR_{Drivetrain}	0.94%	1.01%	0.78%

measurements, however, so it was necessary to analyze parts of the signal where the voltage levels were not shifted due to a previous breakdown. Figure 7 shows the results of the simulation with the gear mesh capacitance assumed constant at the minimum calculated value. An evaluation of the different voltages and the resulting voltage dividers for the simulation and measurement are found in Table 1. While the BVR+ is a little underestimated in the calculations, the GVR and

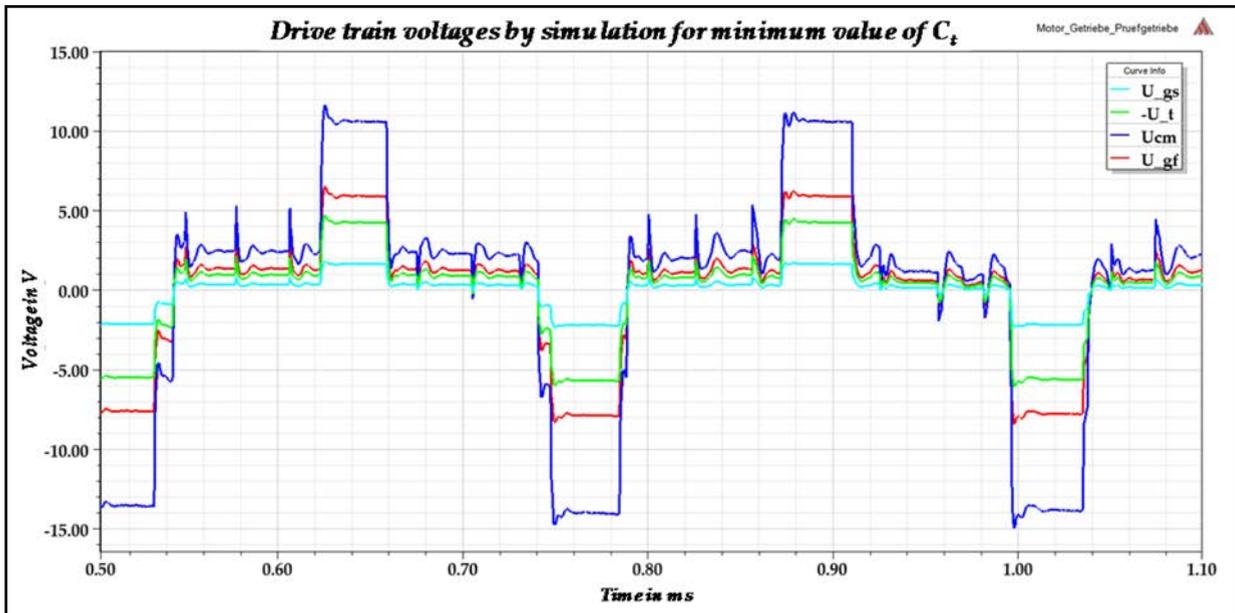


Figure 7 Calculated voltages using the simulation model and a measured common-mode voltage.

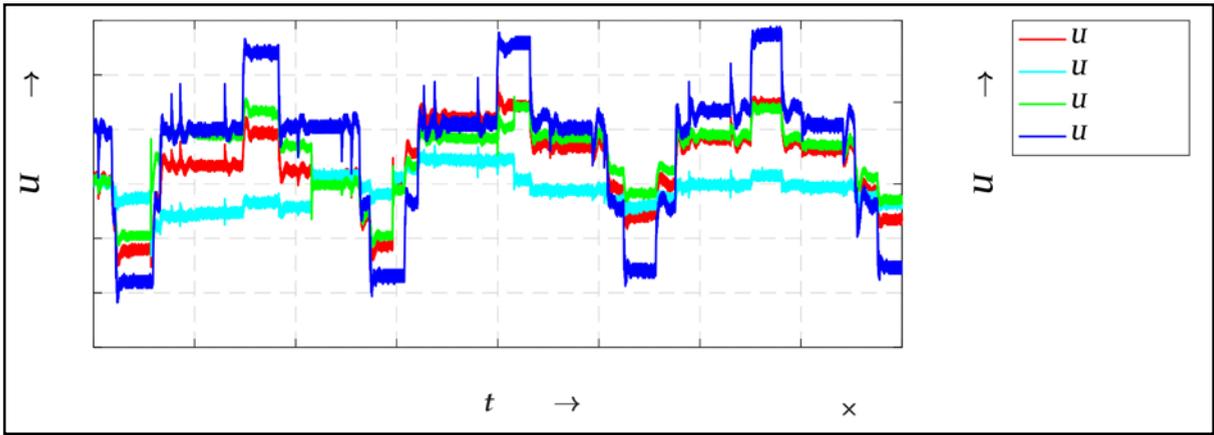


Figure 8 Measured voltages in the drivetrain with insulated motor bearings.

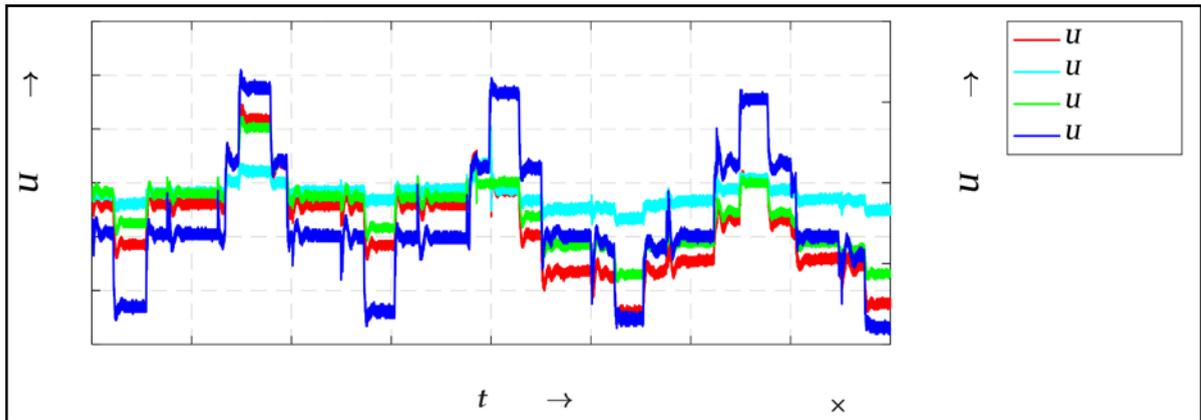


Figure 9 Measured voltages in the drivetrain in train with insulated motor and fast-shaft bearings.

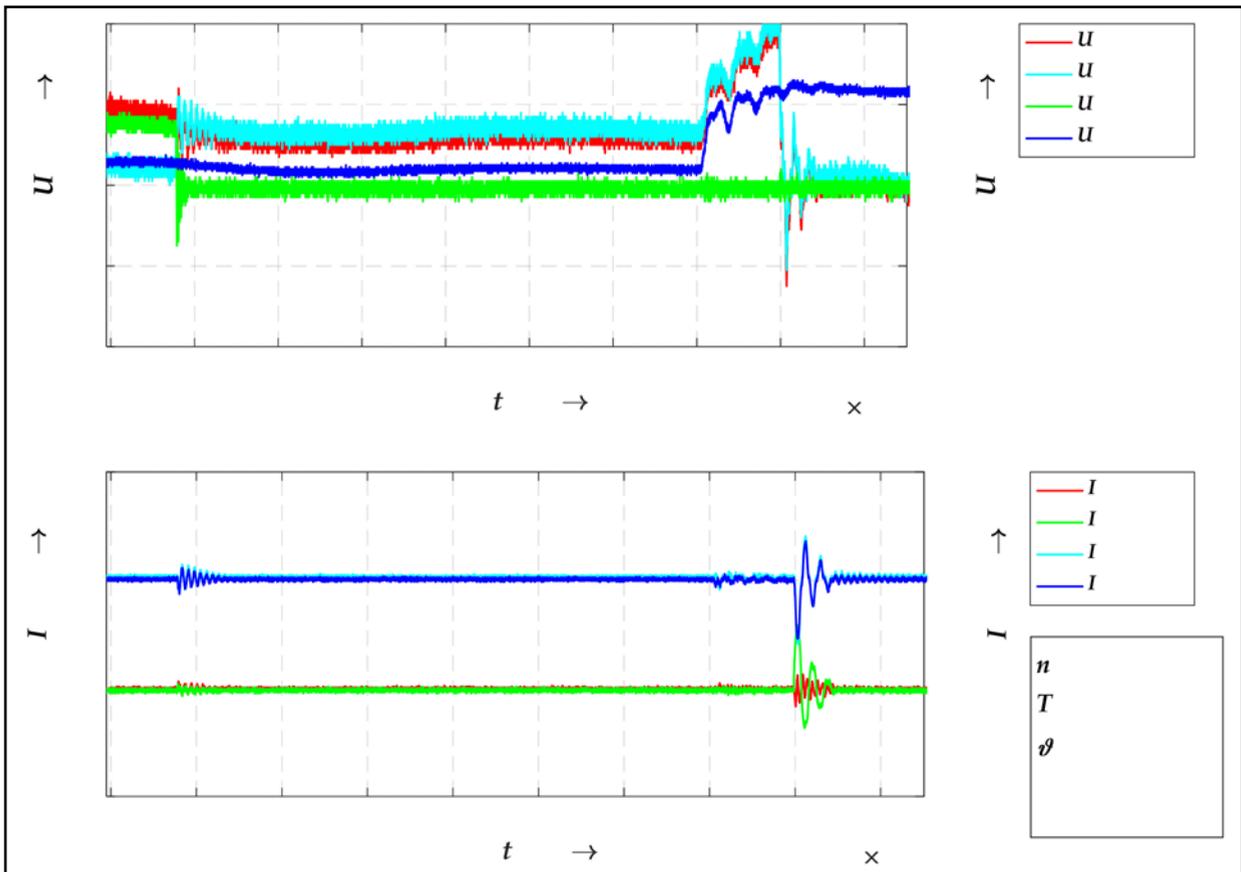


Figure 10 Breakdown of the gear mesh voltage and subsequently in the slow-shaft bearings.

	normal system	hybrid bearings in motor	insulated fast-shaft and motor bearings	insulation + conductive slow-shaft bearing	insulation + conductive gear mesh
U_{gf}	9.1V	12.4V	14.9V	13.1V	13.7V
U_t	4V	5.4V	6.5V	13.1V	0V
U_s	5.1V	7V	8.4V	0V	13.7V

$BVR_{\text{Drivetrain}}$ show a good correlation as the measured values are in between the two calculated extreme values for the minimum and maximum of the gear mesh capacitance C_t .

Influence of Insulations on Drivetrain Behavior

Insulations appear to be one possible solution to avoid harmful parasitic currents. Especially for motor bearings, the usage of insulated bearings or hybrid bearings is quite normal. For this research the influence of such insulations on the remaining part of the drivetrain was investigated. Figure 8 shows the voltages in the test rig with insulated motor bearings. The curves show that voltages exist at the gearbox shafts. The voltage drops during fix steps of the common-mode voltages also show that there still are breakdown events in the gearbox. An analysis of the voltage divider leads to a BVR^+ of 3.4% and a $BVR_{\text{Drivetrain}}$ of 0.73%.

In a next step also the fast-shaft gearbox bearings were insulated by removing the shorting wire that was used to measure the bearing current over these bearings. Figure 9 shows the results of these measurements that at a first glance look quite similar. However, the BVR^+ increased to 3.8% and the $BVR_{\text{Drivetrain}}$ increased to 0.88% of the common-mode voltage. This increased voltage divider leads to EDM-currents at the slow-shaft of the gearbox (Fig. 10). In the figure one can see at first a breakdown over the gear mesh with small, capacitive currents as the systems capacitors are reloaded. As a result, the slow-shaft voltage U_s increases to the same level as the fast-shaft voltage U_f because they are in the same loop now. With the next voltage step of the common-mode voltage, the voltage exceeds the critical level for the bearing GL4 and a discharge occurs. This discharge is also fed by the other capacitances of the network, as is shown due to the almost identical currents that flow through the fast-shaft, the bearing GL4 and the ground connector.

This behavior shows that it is important to apply insulation as a mitigation for EDM currents carefully. A wrong usage might just shift the electrical stress to other parts of the drivetrain and might even increase it as well. In Table 2, this is further demonstrated for an example system. With each insulation — starting with the motor bearings — the shaft voltages increase. The last two columns show the effect if one of the remaining contacts becomes conductive, due, for example to a discharge or just mixed lubrication from the operation conditions — and how this affects the remaining voltages. The elements on the slower side of the gearbox might face large voltages that they probably cannot endure as their film-thickness and thus their critical breakdown voltage is comparatively low due to the low hydrodynamic speed. As the torsion makes it difficult to insulate the gears, they are especially in danger if all other components are insulated. The dynamic of the gear mesh will probably lead to discharges and thus damage the tooth flanks.

Conclusion

This work gives a small impression on the effect and the behaviour of electric stress in drive trains with gearboxes. As an electric system, the gearbox behaves like a capacitance voltage divider due to the separating lubricant films in the machine elements. Insulations like hybrid bearings might reduce the electrical stress in one component like a motor, but it is important to consider the whole drive train as otherwise the problems just might be moved to other parts. As an insulation of the pinion or the wheel is quite difficult and the lubricant film in the gear mesh is not so stable due to the dynamic of the system, these components are especially endangered in regards of harmful discharges. Depending on the system this could lead to even higher costs if for example a gearbox with long delivery time has to be repaired or replaced compared to standard motor. **PTE**

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References

- Furtmann, A. and G. Poll. "Evaluation of Oil-Film Thickness Along the Path of Contact in a Gear Mesh by Capacitance Measurement," *Tribology Online*, Vol. 11, no. 2, pp. 189-194, 2016.
- Hausberg, V. "Elektrische Lagerbeanspruchung umrichter gespeister Induktionsmaschinen" (German), "Bearing Stress of Converter Supplied Induction Motors," Dissertation. Düsseldorf: VDI-Verl., 2002.
- Mütze, A. "Bearing Currents in Inverter-Fed AC Motors," Dissertation, Aachen: Shaker, 2004.
- Tischmacher, H., S. Gattermann, M. Kriese and E. C. Wittek. "Bearing Wear Caused by Converter-Induced Bearing Currents," *IECON 2010 - 36th Annual Conference of IEEE Industrial Electronics*, 2010, pp. 784-791.
- Radnai, B. "Wirkmechanismen in Spannungsbeaufschlagten Wälzlagern" (German), "Modes of Action in Voltage-Loaded Rolling Element Bearings," Dissertation. Kaiserslautern: Technische Universität Kaiserslautern, 2016.
- Tischmacher, H. "Systemanalysen zur Elektrischen Belastung von Wälzlagern bei Um- richter gespeisten Elektromotoren," (German), "System Analyses Regarding the Electrical Stress in Rolling Element Bearings of Inverter-Fed Electrical Machines," Dissertation, Institut für Antriebssysteme und Leistungselektronik, Gottfried Wilhelm Leibniz Universität Hannover, Hannover, 2017.
- Kriese, M. et al. "Influence of Bearing Currents on the Bearing Lifetime for Converter-Driven Machines," *2012 XXth International Conference on Electrical Machines (ICEM)*, 2012, pp. 1735-1739.
- Furtmann, A., H. Tischmacher and G. Poll. "Extended HF Equivalent Model of a Drivetrain," *2016 XXII International Conference on Electrical Machines (ICEM)*: IEEE, 2016, pp. 2244-2250.
- Tischmacher, H., I. P. Tsoumas, and A. Furtmann, "Extended Probability Model for Discharge Activities in the Drivetrain of Converter-fed Electric Motors," *2015 17th European Conference on Power Electronics and Applications (EPE'15 ECCE-Europe)*: IEEE, 2015, pp. 1-10.

Holistic Simulation of Gearboxes — System Simulation

Sebastian Grützner

Introduction

Gearboxes are important assemblies within mechatronic systems. During the design phase of such systems it is essential to know the gearbox behavior under consideration of dynamic interactions with its environment. Holistic system simulation helps the engineer to understand this and to improve, adjust, or optimize gearboxes and their application.

This paper examines three applications with gear drives:

- Noise development in a planetary gear system
- Interactions between a gearset and an electric drive
- Thermal behavior of an actively cooled gearset

The examples demonstrate how systems models can be created and analyzed using the possibilities in *SimulationX* in order to understand, improve, or predict system behavior.

Reduction of Operational Noise by Optimization of Teeth Numbers

Modern powertrains of electric drive cars are driven by small machines with high speeds, e.g. — up to more than 10,000 rpm. These machines are coupled to planetary gearboxes with high transmission ratios, which can lead to high noise contrary to current comfort requirements. Identifying potential natural frequencies in gearsets is critical as part of the design process to ensure a long lifetime of the mechanical components and reduce operational noise. In this paper we present the comparison of four design variants of a planetary gear set with four planets.

Four design variants are discussed, which can be mostly described by changes in two design parameters:

Type	# Teeth Ring	# Teeth Planet	# Teeth Sun	Normal Modulus	Helix Angle	Contact Ratio	
						R-P	S-P
Var. 1A	92	19	52	1.55	18.6	2.8	2.9
Var. 1B	90	19	50	1.55	18.6	2.8	2.9
Var. 2A	108	24	60	1.25	23.0	3.4	3.7
Var. 2B	106	24	58	1.25	23.0	3.4	3.7

The type-A variants use a 4x-symmetry of the sun gear, whereas the type-B variants use a 2x2-symmetry. Thus variants A and B differ in the contact phase angle at the planet-sun contact with 0° and 90°, respectively. The type-1 and type-2 variants differ in the geometry, including number-of-teeth-per-planet; the normal modulus; the helix angle; and the total contact ratio. The task is to find the variant that ensures the lowest operational noise.

In general, a simulation model is built to accomplish a particular analysis task; here we can work with a 1-D rotational system (Fig. 1).

Pre-defined, *Modelica*-based model elements representing inertias, loads, stiffness or detailed tooth contacts (gear pair meshings) of the planetary make it easy to create large, detailed models. Please refer also to References 1 and 2, where you can find a detailed description of the planetary gearbox model components, including all necessary fundamentals.

Depending on the analysis task, it is also possible to represent the planetary as a three-dimensional, multi-body system (MBS) that offers the representation of up to six-degrees-of-freedom for each component. MBS enables the

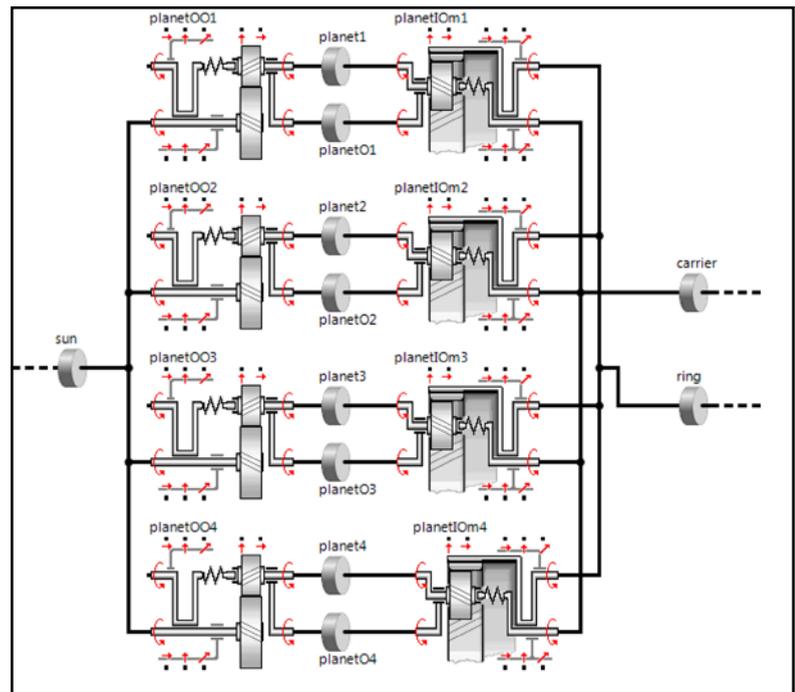


Figure 1 Diagram view of a planetary gearbox with four planets as a 1-D rotational system in *SimulationX*.

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analysis of spatial interactions and provides an intuitive graphical feedback (animation) of the parameters and behavior, including the mode shape analysis of natural frequencies. Figure 2 shows the diagram as well as the 3-D view of the corresponding MBS model of our planetary gearbox.

The simulation model was used to determine the natural frequencies as well as the reduction in torque magnitude for each variant, compared to the reference concept. A steady-state analysis was performed on the variant models for planet speeds from 0 to 4,500 rpm and excitation frequencies from 0 to 15,000 Hz. Fast Fourier transformations (FFT, order analysis) of the time-domain results, displayed as Campbell diagrams, show big differences between the variants—especially 1A and 2B, in the range of 4,300 Hz (Fig. 3).

The simulation demonstrated that variant 2B is the best modified design, compared to the reference concept variant 1A. Using variant 2B, it is possible to reduce the torque at the sun gear at the primary natural frequency from 3.81 Nm to 1.23 Nm, i.e.—a reduction of 68%.

Influence of Electrical Grid Disturbances on Gears

Disturbances in the electrical grid influence the system behavior of electrically driven machines or generators (e.g., wind energy plants (WEP)) and therefore its lifespan.

Reference 3 describes the analysis and identification of such grid disturbances and their influence on bearing loads in a WEP. In many cases it is impractical if not impossible to switch generators off during incidents or faults in the electrical grid; official guidelines and standards define permissible grid fluctuations and voltage drops for electrical power customers and suppliers (e.g., EN50160).

When designing the mechanical system, it is important to analyze the influences of grid disturbances such as symmetric or asymmetric short circuits and the corresponding voltage

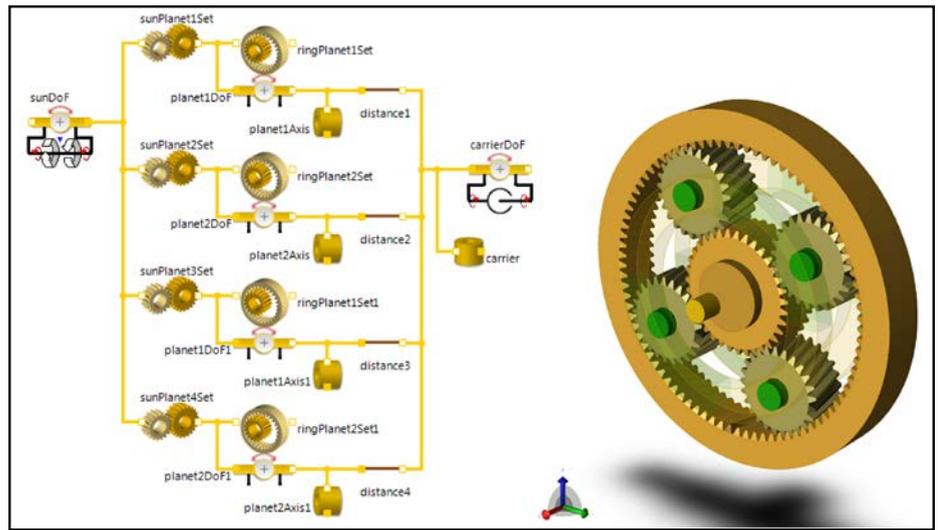


Figure 2 Diagram and 3-D view of a planetary gearbox with four planets as MBS in SimulationX.

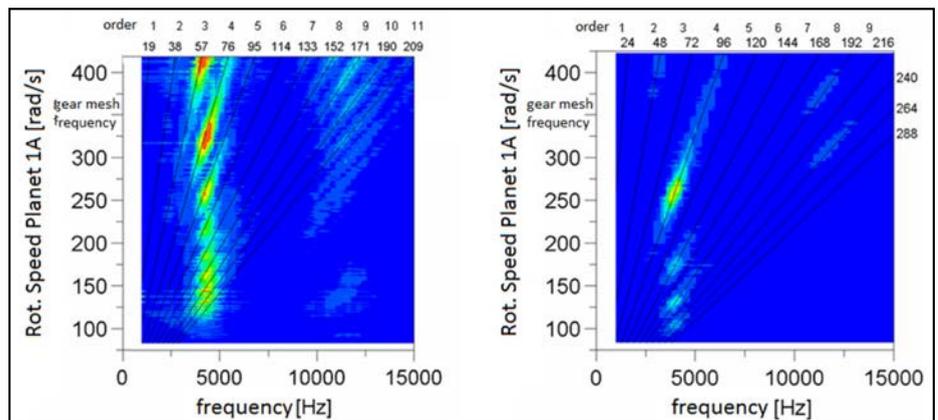


Figure 3 Campbell diagram for order analysis and resonance investigation (ITI-ORD by ESI ITI GmbH).

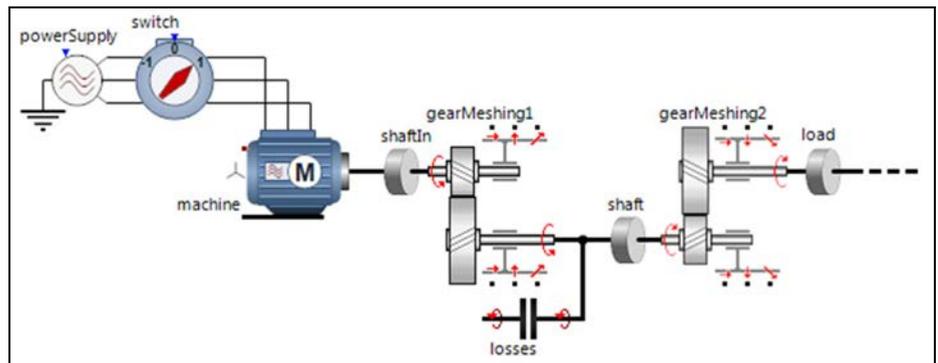


Figure 4 Model of an electric-driven work machine in SimulationX.

drops. Figure 4 shows the model of the drive of a machine with a geared motor. There are two gear pairs between machine and load. The machine drives a speed-dependent load. Each gear pair meshing element represents a constant mean gear meshing spring stiffness and its rotating backlash.

During steady-state operation at 116 rpm load speed a (3-pole) short circuit occurs between 10 and 10.1 s; high peaks of the tooth contact forces can be seen in Figure 5. The maximum values are up to 4 times higher than the mean load.

This example shows how important it is to consider realistic interactions with other (e.g., electrical) systems using physical models when designing the mechanical system. In contrast, generic assumptions tend to result in over-dimensioned systems.

Temperature Analyses of Gearsets

The system shown in the model (Fig. 4) is cooled by an oil cooling system for which another task must be solved, i.e. — what happens when the cooling system drops out, and how much time do we have to stop the system auto-

matically to avoid oil flaming or teeth damage as a result of overheating?

Figure 6 shows the detail of an extended model of the work machine drive. It contains a hydraulic and pneumatic model of the oil cooling circuit as well as a thermal model to represent the heat transfer from the gear pair meshings to the cooling oil. For these kinds of long-term analyses it is quite accurate to work with mean gear mesh stiffnesses and only low-frequency excitations. We assume a gear meshing efficiency of 95%.

Figure 7 shows the main results of the simulation: during normal steady-state operation the oil sump temperature is approx. 95°C. At 5 minutes the oil cooling system is disrupted and the oil temperature quickly increases. After approximately 80 seconds the limit temperature of the oil is reached. Beyond this point we can expect

damage to the gears or the gearbox because of decreasing viscosity and loss of lubrication of the oil film between the teeth contacts. Furthermore, after 2.5 minutes the oil's flashpoint is reached.

Based on these results we can design a control system that shuts down the machine automatically (in this case within approx. 60 seconds) to avoid damage. It is indeed possible to test such an emergency shutdown on a virtual system.

Outlook — WindTwin Project: New Ways of Monitoring the Maintenance Condition of Wind Turbines Using Virtual Plants

Research has shown that preventive maintenance of wind turbines costs 25% less than reactive maintenance, and that predictive maintenance costs 47% less. Also, there is a need to increase wind turbine reliability to 99.5% (Ref.3), which can be achieved by developing new data analytics techniques, processing, and visualization for effective operations and maintenance.

The upcoming WindTwin project aims to revolutionize the monitoring and maintenance of wind turbines—both onshore and offshore—by developing an innovative digital platform that will virtualize the WPP (wind power plant) using a digital twin of the wind turbine behavior and operation. These virtual plants—or hybrid twins—will combine the mathematical models describing the physics of the turbine's operation with sensor data collected and processed from real assets during real-world operations. For example, condition monitoring will be applied on the gearbox, and sensors will be placed on the real wind turbine asset; the data being collected will be processed and transferred to the hybrid twin, continuously resulting in a close to real digital twin of the wind turbine showing real-time performance. These virtual models will allow wind farm operators to predict failure and plan maintenance—thus reducing both maintenance costs and downtime.

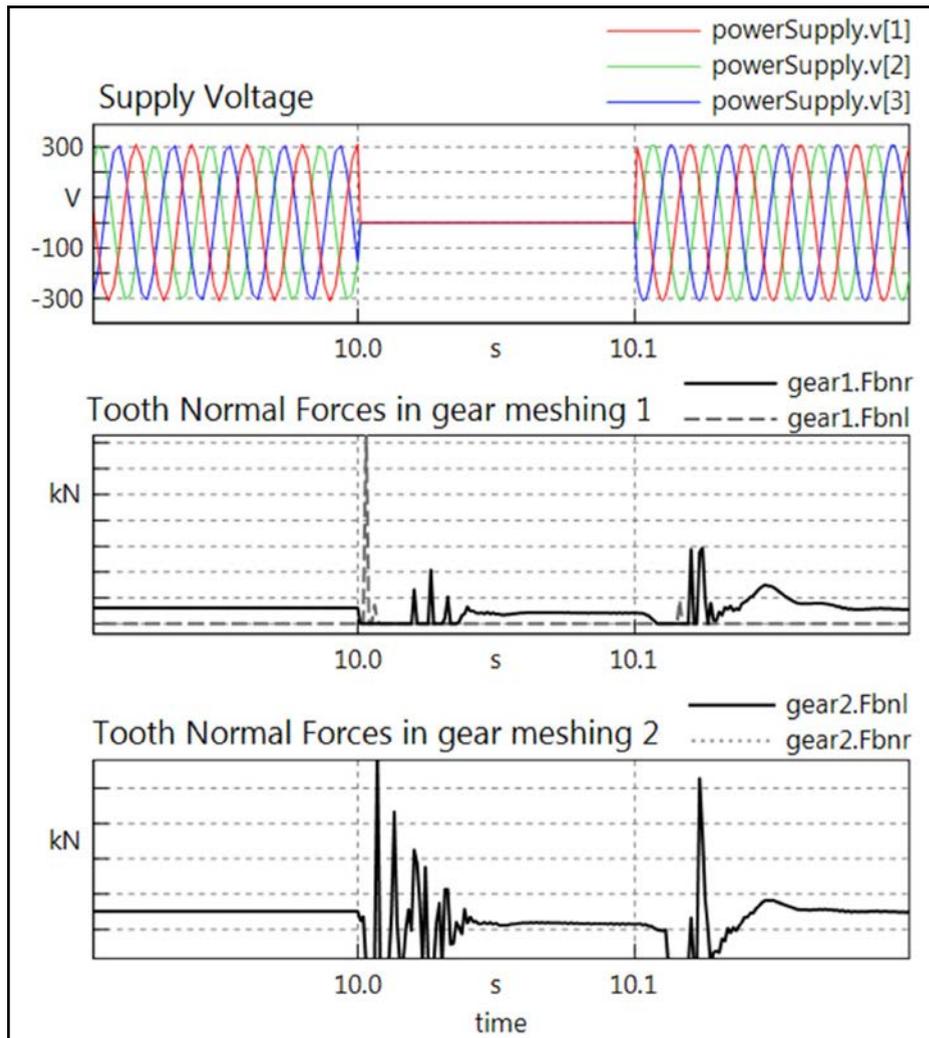


Figure 5 Top—supply voltage with short circuit breakdown; Middle, Bottom—tooth contact normal forces of gear 1 and gear 2 each for both flanks.

Summary

- The holistic system simulation of gearboxes in every field of application helps us to analyze and understand the complete system behavior.
- Several examples demonstrate that it is important to take physical interactions from different sub-systems into account, e.g. — mechanics, electronics, thermal, hydraulics and control.
- All experiments (modeling, result analysis, etc.) were done completely in *SimulationX*.
- Intuitive, application-oriented model libraries for representing all sorts of systems make it possible to quickly create and parameterize system simulation models. Options in the component models enable switching between various degrees of calculation detail according to what type of analysis task needs to be done.
- Furthermore, the object-oriented modeling language *Modelica* enables the modeler to extend existing library elements or create new library elements based on new requirements. (Note: the paper cited in Reference 5 summarizes the advantages of modeling using *Modelica* in comparison to other technologies.)
- Also possible is the coupling or integration of sub-models from other simulation platforms via the functional mock-up interface (FMI). This technology also makes it possible to integrate *SimulationX* models into other environments.
- Thus system simulation is the most important tool in the layout, improvement and analysis of systems, and a decisive part of CAE (computer-aided engineering) development process of machines with gearboxes. **PTE**

References

1. Schreiber, U. and S. Grützner. "Planetengetriebe mit veränderlicher Steifigkeit im Zahnengriff— Modellierung und Mehrkörpersimulation am Beispiel von Automatgetrieben," Dresden Maschinenelemente Kolloquium 2005, Dresden: TUD press Verlag der Wissenschaften GmbH 2005.
2. Dresig, H. *Schwingungen Mechanischer Antriebssysteme* (Kap 4.7), 2, Auflage, Springer-Verlag Berlin Heidelberg, 2006.
3. Noack, R., W. Horn, K. Peter and A. Magdanz. "Dynamische Effekte im Mechanischen Triebstrang von WEA Durch Störungen im Elektrischen Netz," VDI-Tagung - Schwingungen und Dynamik von Windenergieanlagen, Bremen 2016.
4. Grützner, S. and A. Magdanz. "Simulation

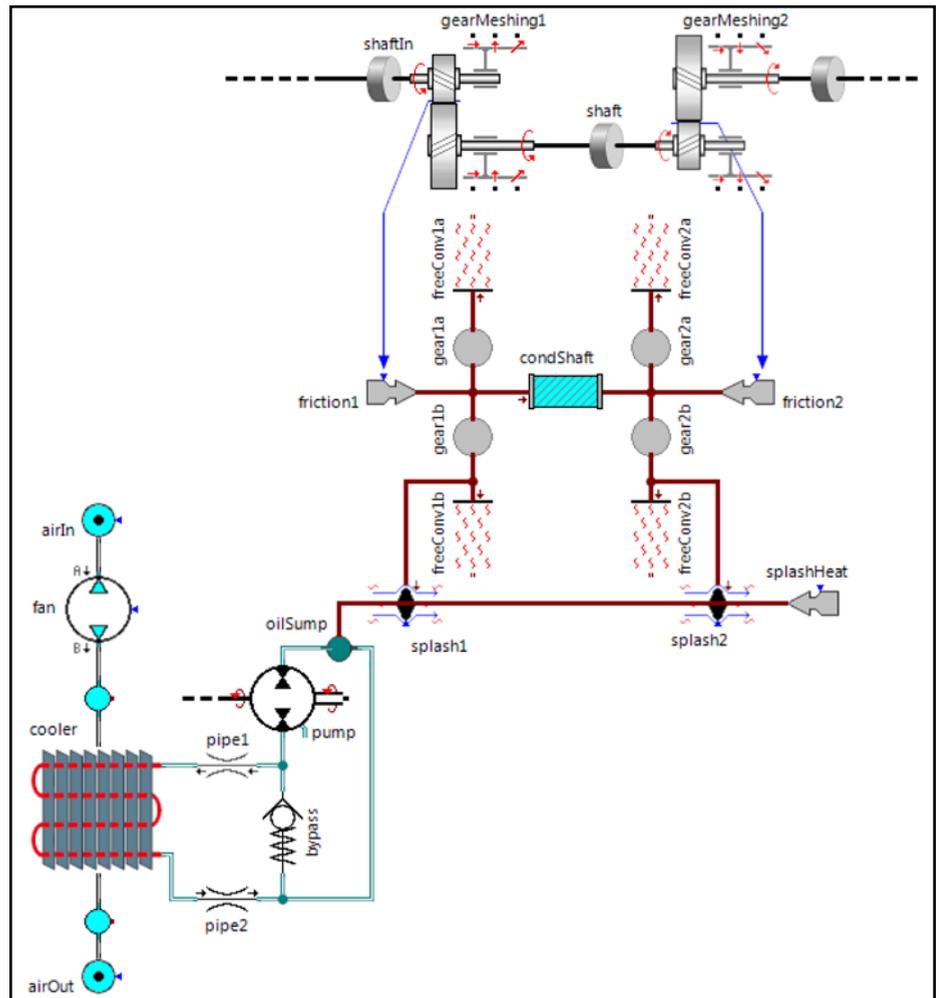


Figure 6 Model of a machine with detailed sub-models of gear oil exchange and heat transfer from teeth to oil in *SimulationX*.

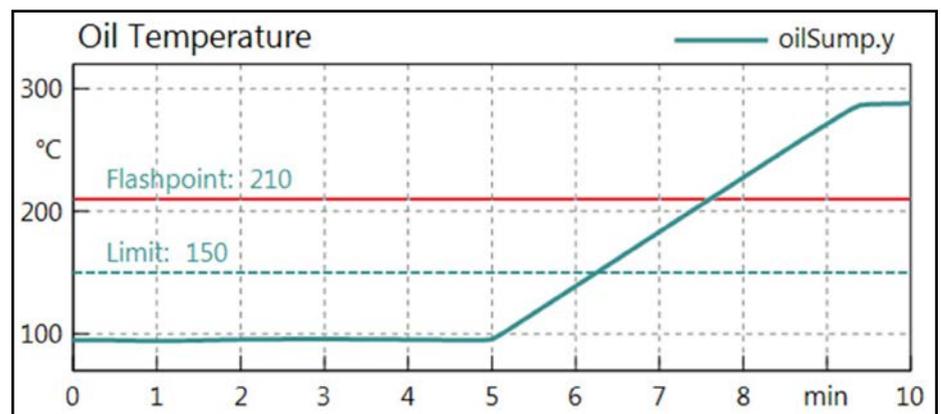


Figure 7 Model of a work machine with detailed sub-models of gear oil exchange and heat transfer from teeth to oil in *SimulationX*.

von Antriebssystemen im Zusammenhang mit Elektromechanisch-Thermischen Wechselwirkungen am Beispiel eines Gurtförderers," VDI-Newsletter Juni 2017, www.vdi-wissensforum.de/news/simulation-von-antriebssystemen.

5. Bahnert, T., A. Haase and S. Chaker. "Analyse und Beherrschung von Getrieberasseln in Leichtbau Antriebseinheiten," VDI-Tagung-Kupplungen und Kupplungssysteme in Antrieben, Karlsruhe 2017.

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Twin Disc

CELEBRATES 100 YEARS OF MANUFACTURING INNOVATION

Twin Disc, Inc. is celebrating its 100th anniversary throughout 2018. The company began in Racine, Wisconsin in 1918 with the introduction of the twin disc farm tractor clutch. Since then, Twin Clutch has upgraded the performance of transmissions involved in farming, construction and marine applications.

One of its major contributions to manufacturing history was Twin Disc's involvement with the LCVP (Higgins boat) during World War II. The LCVP was the landing craft extensively used for amphibious landings that was designed by Andrew Higgins. Dwight D. Eisenhower was quoted as saying the vehicle was crucial to the Allies victory in Europe.



"Our company designed and built half the transmission for the LCVP and it changed everything," Batten said. "These boats went to Europe and Asia and when the war ended they stayed there. Suddenly, we had this product all over the world being used for fishing and workboats, etc. Almost overnight, we became a global company."

Twin Disc began opening sales offices around the world and played a significant role in the MacArthur Expansion in 1950s Japan. The company was tied to both the marine and construction transmission markets and expanded at a rapid pace.

Oil recessions in the 70s and 80s slowed things down a bit, but one of the most significant challenges was that many of Twin Disc's customers began building the transmissions themselves—vertically integrating the product into their own manufacturing facilities.

Batten believes the company persevered during the tougher times with a manufacturing and office staff known for its longevity, adaptability, curiosity and loyalty.

"The average seniority for our employees was 25+ years in the shop and 20+ years in the office," Batten added. "They've pulled through restructures and witnessed plenty of ups and downs. It's hard to argue against that Midwest work ethic. I believe these are many of the traits the staff has had going back 100 years."



Today, Twin Disc is focusing more on controls and system integration instead of individual components, technologies for propulsion controls, thrusters, steering systems, drives, etc. instead of basic clutches.

"This anniversary is a chance for us to reflect on the inventiveness of the company's founders and my predecessors, as well as the resilience and willingness to adapt that has allowed Twin Disc to flourish for a century," said Batten. "It's also an opportunity for us to express our appreciation for our employees, customers, and the communities we work and live in."

Batten is bullish on the U.S. manufacturing market. He knows that in order to succeed in the future, the company will need additional output here in the United States. The goal is to be a leader in hybrid technologies for diesel applications in the foreseeable future.

In order to accomplish this, Twin Disc will need a new generation of talent similar to the workforce that has made it so successful for 100 years.

"Trade schools and two-year education paths are available for kids today to make a great career," Batten said. "They don't need a four-year degree to be successful in life. They simply need to see the opportunities that manufacturing can offer."

Batten added that the organization is ready and willing to hire additional team members in the coming months. "We're looking for new talent right now. If you want to come to Racine, Wisconsin, we have jobs to fill!"

Twin Disc is preparing a series of local, national and



international events and promotions to celebrate its 100th anniversary this year, including an international distributor meeting at its corporate headquarters. Twin Disc will participate in local Racine events, including the Lighthouse Run, Independence Day Parade, and the WKLH Work Force Tour.

Other North American and international Twin Disc subsidiaries, in Belgium, Italy, Singapore, India, and Australia, will also celebrate the 100th anniversary with events and promotions.

“We’re looking forward to all these opportunities to celebrate our history, and more importantly, the people who helped make Twin Disc what it is today,” Batten said. “It is my hope that these reflections encourage us to look toward our next 100 years and inspire the next generation of Twin Disc employees to imagine and develop new ways to continue to put horsepower to work.” (www.twindisc.com)

Haydon Kerk Motion Solutions

REVISES 2018 CATALOG AND DESIGN GUIDE

Haydon Kerk Motion Solutions, a business unit of AMETEK Advanced Motion Solutions, announces the release of its new Catalog and Design Guide, revised for 2018. The new Haydon Kerk catalog has been updated and expanded with new product sections.



The new catalog and design guide illustrates a wide range of products engineered for use as building blocks in sophisticated linear motion assemblies depending on the customers’ application needs. The catalog is a “starting point” to help explain Haydon Kerk technology, products and core capabilities. Customers are invited to work directly with Haydon Kerk’s engineering team to customize components or to integrate them into a unique customized system solution.

The catalog is divided into 3 major sections: 1) Precision lead screw and nut assemblies; 2) Linear actuators and stepper motor drives; and 3) Motorized and non-motorized linear rail systems. In addition to basic product information, each section includes a brief overview of the technology behind the products, part number construction, sizing charts, and product comparison charts.

Typical applications for Haydon Kerk products include robotics, infusion pumps in medical equipment; liquid handling equipment used in laboratory automation; transport stations and valves in semiconductor manufacturing equipment; and inspection, test, dispensing and 3D printing equipment used in industrial automation, camera, lighting, projectors, antenna drives and numerous other high-tech precision motion systems. (www.haydonkerkpittman.com)

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SEPAC and Placid Industries

COMPLETE MERGER AND INTEGRATION

SEPAC, an engineering company and manufacturer of motion control products including electromagnetic clutches and brakes, and Placid Industries, a manufacturer of magnetic particle brakes/clutches, hysteresis brakes and controls, have completed the integration of their businesses after a recent merger. Together, the companies can now offer OEMs a wider range of superior quality, low cost motion control solutions and application expertise.

Founded in 1973, Placid Industries was originally located in Lake Placid, NY, before relocating to SEPAC's headquarters in Elmira, NY. Placid's products are well known throughout the United States and Europe for tension control applications where unwinding/rewinding is required or in applications where torque needs to be controlled independent of RPM. Placid Industries also has the capability to package entire systems which may include a brake or clutch, power supply and potentiometers or ultrasonic sensors for live feedback.

"We are enormously excited to scale our business with the iconic Placid Industries brand," said John Meier, president of SEPAC. "Our strategic acquisition and integration builds out our product line across the full range of the clutch and brake spectrum, brings superior product performance with our proprietary de-cogging technology for smooth running torque, provides the best pricing in the market, and ships same day for rapid turnaround."

"Placid brings more than 50 years of strong technical product performance and applications expertise with a diversified, global customer base on a recurring revenue business model built on rapid deliveries and responsive customer service," said Lonnie Reid, Placid Industries. "We look forward to leveraging SEPAC's robust engineering resources and market footprint to grow our respective franchises together as one leader in motion control." (www.sepac.com)

Danfoss

APPOINTS BUSINESS DEVELOPMENT MANAGER FOR OIL & GAS

Danfoss has appointed **Justin Thomas** as business development manager of its Marine, Oil & Gas business for the company's Power Solutions segment.

In this role, Thomas will focus specifically on developing new business relations for long-term strategic sales and partnerships while expanding the company's market share in onshore and offshore applications including, Drill rigs, Fracking units, Artificial Lifts, Offshore Vessels and Jack up rigs.

Thomas brings over seven years of industry experience.



Prior to joining Danfoss he worked for Schlumberger in their Drilling & Measurements division working on land based rigs as a field engineer operating downhole tools/equipment used for drilling, steering and logging hydrocarbon data. More recently he was with Eaton—Crouse Hinds Harsh and Hazardous Electrical Division as a Specification Sales Engineer targeting drilling contractors, operators and OEMs in the upstream oil and gas market.

"Justin joins Danfoss with great industry experience," said Steve Robinson, director of business development, Marine, Oil & Gas, Danfoss Power Solutions. "He will help us continue to strengthen our position as a leading provider of solutions in critical applications for safe and efficient exploration and production of oil and gas."

"I was excited to join Danfoss because of the company's strong commitment and focus on bringing innovative solutions to making oil and gas exploration as safe, efficient and reliable as possible. They have a strong partner network, a global footprint and history of working with global industry leaders," commented Thomas.

He is a graduate of University of Pittsburgh where he majored in industrial engineering with a minor in mechanical engineering. (www.danfoss.com)

Regal Beloit Corporation

ENHANCES PRODUCTS ON WEBSITE

Regal Beloit Corporation has released 360-degree, high-resolution product photography on its website. Each spin is comprised of up to 72 high-resolution photos, providing a level of image clarity that makes product labels legible. This enhancement is the next step in the company's phased approach to implement enhanced digital content.

The Regal website, launched in June 2017, builds on the previous website design through a more robust product evaluation experience and will continue to evolve to meet the most sought-after features requested by customers.

"Our goal is to revolutionize our users' online experiences with a website that offers significantly enhanced digital content over other industrial B2B websites. The details available in our new images enable users to make accurate buying decisions to help ensure they are selecting the correct part," said David Lindsay, manager of performance excellence, Regal Beloit America, Inc.

"We also focused on the sizes of the images to allow for a balance between providing the desired level of clarity with enabling optimal load times. Furthermore, with our mobile-first web strategy, we had to consider the ideal size for hand-held devices as well as desktop users," said Gary Thompson, IT applications architect, Regal Beloit America, Inc. (regalbeloit.com)

September 18–20—CTI Symposium

China CTI Symposium is a three day event providing the latest automotive transmission and drive engineering for passenger cars and commercial vehicles. The international industry event delivers the appropriate platform to find new partners for purchase and sales of whole systems and components. Automobile manufacturers, transmission and component companies give an overview and outlook on technical and market trends. Speakers include representatives from Audi AG, Jatco Ltd., CH-Auto Technology and more. For more information, visit drivetrain-symposium.world/cn/.

September 25–26—PM Sintering Seminar

Penn Stater Conference Center Hotel, State College, Pennsylvania. Held only every two years, this two-day seminar is meant for industry professionals either new to sintering or with intermediate experience in the industry. Topics covered will include information from basic theory and practices to troubleshooting and how to drive down the costs of sintering. Learn from industry experts about: Sintering parts at normal or elevated sintering temperatures; increasing productivity by reducing rework and scrap; improving properties of PM parts with sintering; the latest equipment capabilities; troubleshooting sintering problems; efficiency in daily sintering operations. For more information, visit www.mpif.org.

September 29–October 3—WEFTEC 2018

New Orleans, Louisiana. WEFTEC, the Water Environment Federation's Technical Exhibition and Conference, is the largest annual water quality event in the world. WEFTEC is the largest conference of its kind in North America and offers water quality professionals from around the world with the best water quality education and training available today. An increasing number of abstract submissions from experts in the water quality field results in a world-class technical program of technical sessions and workshops that addresses a diverse and comprehensive list of contemporary water and wastewater issues and solutions including: Energy management, plant operations, regulations, research, utility management, recycling and more. For more information, visit www.weftec.org.

October 2–5—World of Technology and Science 2018

Utrecht, Netherlands. World of Technology & Science is a chain of technology in one location. The five branches include Industrial Automation, Laboratory Technology, Industrial Electronics, Motion & Drives and Industrial Processing. The Motion & Drives show features hydraulics and pneumatics, mechanical drive systems, vacuums and compressors, measurement and feedback systems and control and networking systems. The Automation show features process automation systems, field instrumentation, sensors and motion control and mechatronic systems and software. For more information, visit wots.nl.

October 14–17—Pack Expo International 2018

Chicago, Illinois. North America's largest packaging event will bring together the solutions needed to launch new products and solve production issues. Corporate managers, engineers, sales managers, plant managers, manufacturers and production supervisors, brand and marketing managers, quality controllers, purchasers, research/development and package design-

ers from a wide variety of consumer packaged goods companies (CPGs) will be in attendance. More than 2,500 exhibitors will display state-of-the-art technologies, equipment and materials. The show is co-located with the Healthcare Packaging Expo, bringing pharma/biopharma, nutraceutical and medical device manufacturers together for the latest trends, innovations and solutions. The PACKage Printing Pavilion will showcase smart printing applications, digital color printing options and labeling/coding solutions. The Innovation Stage will feature 30-minute seminars on new technologies and tactics. For more information, visit www.packexpointernational.com.

October 16–18—PBIOS 2018

Odessa, Texas. Every even-numbered year the Permian Basin International Oil Show, Inc. (PBIOS) brings together people from every phase of the petroleum industry. Attendees come to learn about the latest technology, the newest equipment, to transact business and renew friendships. Unlike most exhibitions, the Permian Basin International Oil Show, Inc. is a non-profit venture whose sole purpose is educational, designed to serve the oil and gas industry. PBIOS not only showcases the very latest technology, it also honors the industry's past. A working cable tool rig operates daily on the show grounds during the three-day show, surrounded by trucks and oilfield equipment from the 1930s, a key growth period for the industry in the Permian Basin. For more information, visit www.pboilshow.org.

October 31–November 1—Advanced Engineering 2018

Birmingham, United Kingdom. Advanced Engineering will highlight the latest developments in key industries including aerospace, automotive, composites, connected and, digital manufacturing, advanced materials and new for the show this year – civil nuclear new-build engineering. Topics will cover the full range of advanced engineering capabilities, including: design, processing, manufacturing, materials, supply chain, sustainability, testing & measurement, repair and inspection. Featured speakers include representatives from Boeing, Nissan and ALFED as well as several key engineering lectures from Trinity College Dublin. For more information, visit www.easyfairs.com/advanced-engineering-2018/advanced-engineering-2018/.

December 4–6—Power-Gen International 2018

Orlando, Florida. Power-Gen International provides comprehensive coverage of the trends, technologies and issues facing the generation sector. Displaying a wide variety of products and services, Power-Gen International represents a horizontal look at the industry with key emphasis on new solutions and innovations for the future. Topics include plant performance, cyber security, energy storage, flexible generation and more. To celebrate the 30th anniversary, the show is awarding 30 scholarships to new attendees. Learn more at www.power-gen.com.

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About as Big as it Gets

The Overburden Conveyor Bridge F60

Jack McGuinn, Senior Editor

Its name—Overburden Conveyor Bridge F60—is not very sexy—nor does it reveal for non-engineers much in the way of description.

But it happens to be “the largest *movable* technical industrial machine in the world,” according to available reports. Yes, bigger than the Bagger 293 and NASA’s Crawler-Transporter.

For the non-engineers among us, an overburden conveyor bridge is a piece of mining equipment used in strip mining for the removal of overburden and for dumping it on the inner bank of the open-cut mine. It is used together with multi-bucket excavators—frequently bucket chain excavators—that remove the overburden which is moved to the bridge by connecting conveyors. (In mining, overburden is the material that lies above an area that lends itself to economical exploitation, such as the rock, soil, and ecosystem that lies above a coal seam or ore body.) Overburden is removed during surface or strip mining; because it is typically not contaminated with toxic components, it is also used to help restore a played-out mining site to some semblance of its original appearance before mining began.

The F60 (the cutting height is 60 m) is a series designation of five overburden conveyor bridges used for brown coal open-cast mining in the Lusatian coalfields of Germany. They were built by the former Volkseigener Betrieb (VEB) TAKRAF (global German industrial company based in Leipzig) when the publicly owned operation was the main legal form of industrial enterprise in post-war Germany. The first conveyor bridge was built—over four years—in 1972, being equipped with a feeder bridge in 1977. The second was built (two years) in 1974, having been equipped with a feeder bridge during construction. The third bridge was completed in 1978, being provided with a feeder bridge in 1985. The fourth and fifth conveyor bridges were built 1986–1988 and 1988–1991.

So how big is “big”? *Ach du lieber!-big.*

Check this out:

Length: 502 m (higher than the Empire State Building)

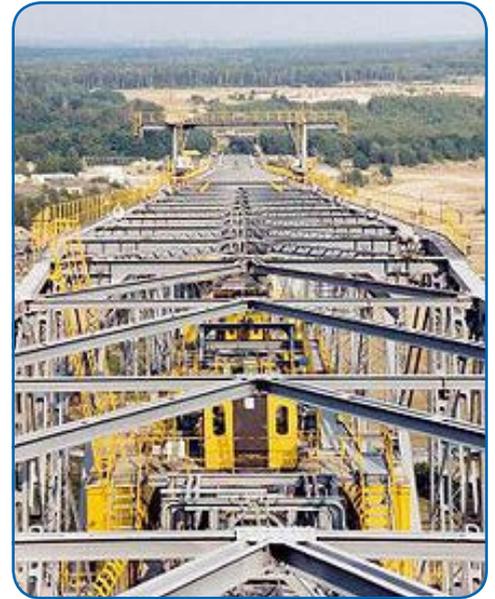
Width: 240 m

Height: 80 m

Weight: 13,600 metric tons

Also described as “a lying Eiffel tower,” the Overburden Conveyor Bridge F60 is indeed the largest land vehicle of any type by physical dimensions.

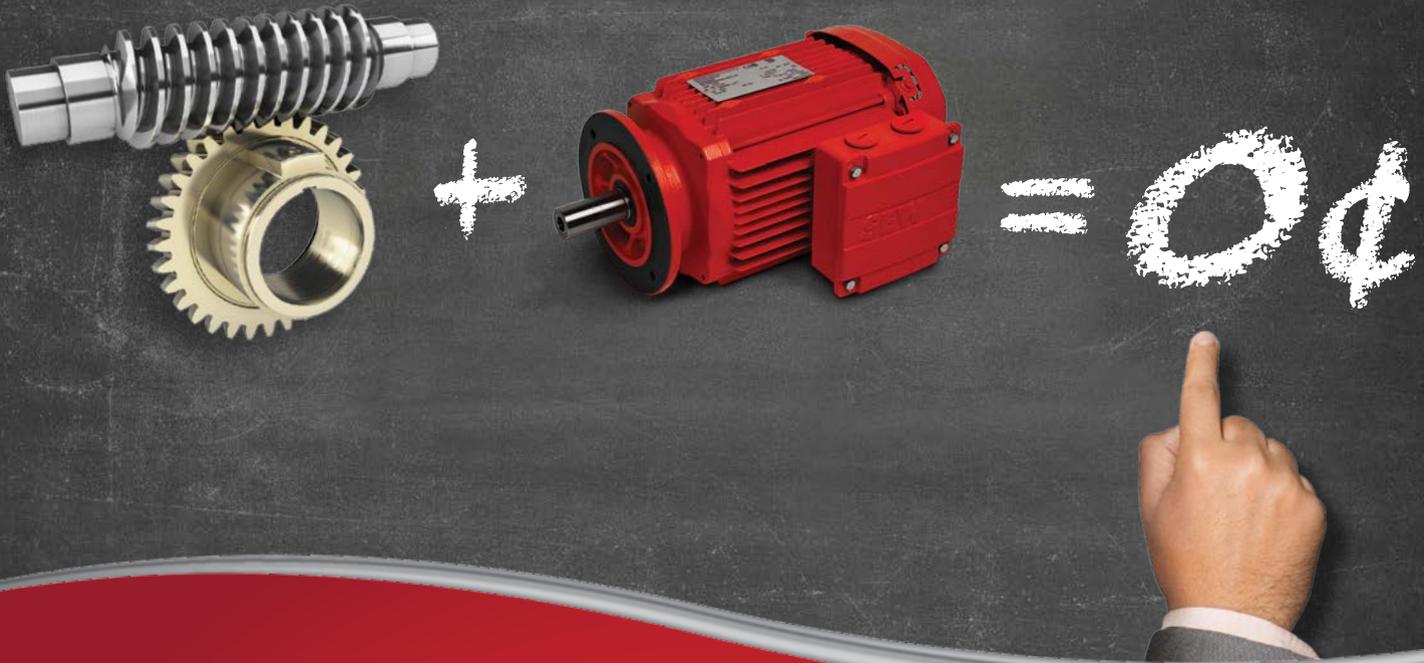
The behemoth features two chassis with wheels (bogies)—one on the dumping side (front) and one on the excavating side (back)—running on two rails (1,435 mm or 4 ft. 8.5 in standard gauge). In addition to the two rails on the excavating side, there are another two rails for the transformer and cable cars. There are a total of 760 wheels on the bogies, of which half (380) are powered. The maximum speed of the F60 is 13 m/min (0.78 km/h); operating speed is 9 m/min (0.54 km/h).



The F60 has two excavators on the sides to do preparatory work, one each on the northern and southern cross-wise conveyor. They each have an output of 29,000 m³/h (38,000 cu yd/h) (26,448 t/h or 26,030 long ton/h or 29,154 short ton/h), which corresponds to a volume the size of a soccer field with a depth of 7–8 m (23–26 ft). There are nine various overburden conveyor belts with a speed of 10 m/min (0.60 km/h). The F60, including the two excavators, requires 27,000 kW (36,000 hp) of power. The bridge needs 1.2 kWh (4.3 MJ; 4,100 BTU) of electricity to convey one cubic meter (1.3 cu yd) of overburden—from the cross-wise conveyors up to the dumping—at a height of 75 m (246 ft).

Four F60s remain in operation in the Lusatian coalfields today; the fifth F60—the last one built—is in Lichterfeld-Schacksdorf and is accessible to visitors and tourists. The installation was carried out between 1988 and 1991 in the Klettwitz-Nord open-cast mine. The F60 began operation in March 1991. Between its commission and shut-down in 1992, it moved around 27 million cubic meters of overburden. After German reunification the mine became the responsibility of the Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft (Lusatian and Middle-German Mining Administrative Society, LMBV), which closed the mine on the orders of the German federal government and renovated it economically and in a way not harmful to the environment.

Between 2000 and 2010 the Internationale Bauausstellung Fürst-Pückler-Land (International Building Exhibition [IBA]) was active in providing new momentum to the region, and the former open-cast mine of Klettwitz-Nord is an example of that. The mine has been converted into a “visitors’ mine” and the conveyor bridge has been accessible since 1998. Added, various sound-and-light installations enhance the facility’s attraction for visitors (tourists). The Overburden Conveyor Bridge F60 is just one outsize example of the century-old German tradition of producing international construction exhibition projects that encourage urban development in the form of great constructional innovations. (Source: Wikipedia.) **PTE**



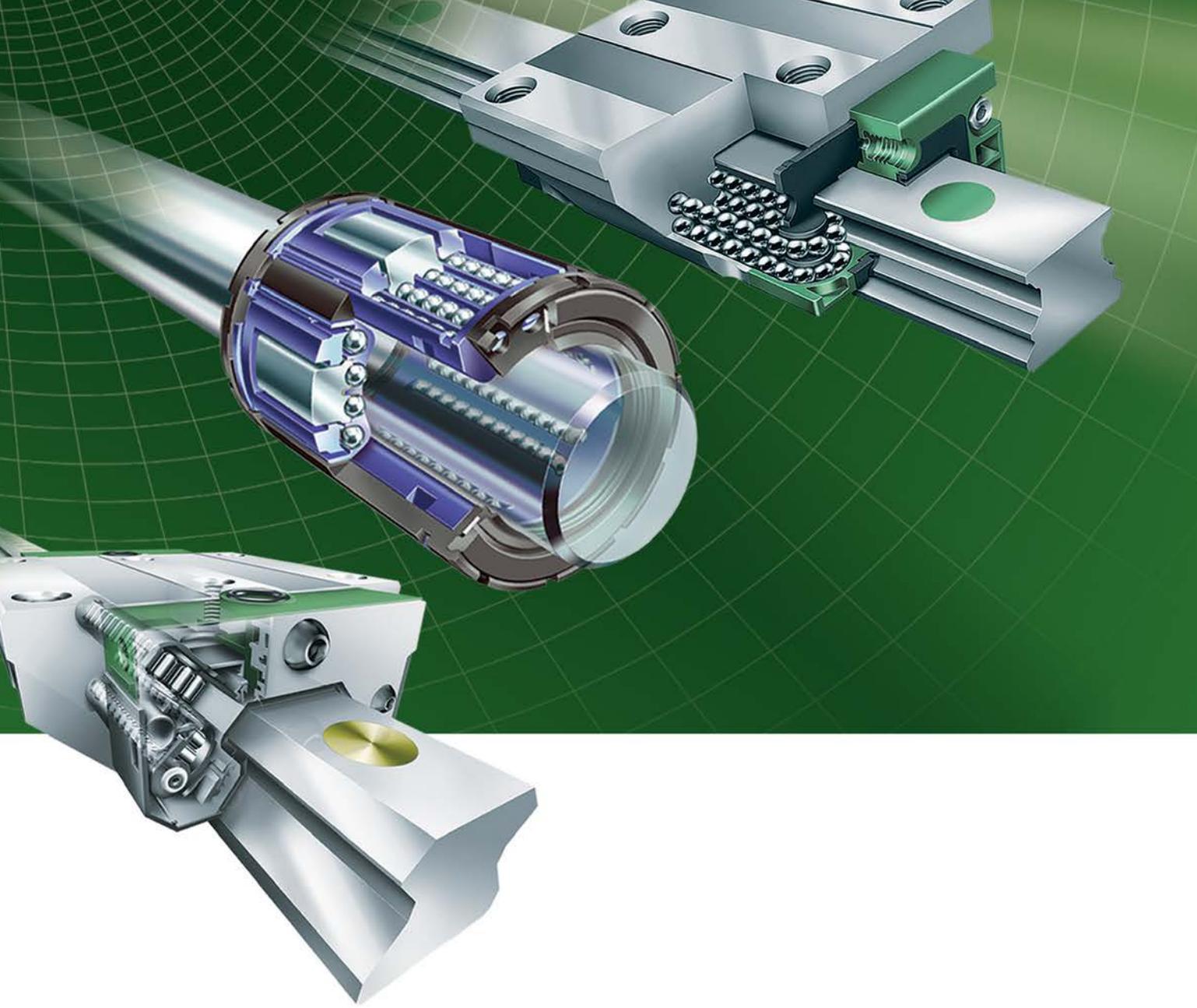
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