PTE

POWER TRANSMISSION ENGINEERING™

OCTOBER
2025

A HISTORY OF MOTION + POWER

ADVANCED LUBRICATION TECHNOLOGIES

POWER DENSITY TRACTION WITH MOTOR CONTROL

TECHNICAL

Tuning Flank Waviness for Minimized Mesh Force Variation

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This motion controller has it all

EtherCAT control, PLC power, and so much more.

LS Electric XMC Motion Controller

Starting at: $857.00 (XMC-E08A)

The LS Electric XMC motion controller has numerous state-of-the-art features built into its compact brick-style design. These controllers are optimized for advanced motion control, are available in 8- or 16-axis models, and offer a variety of high-tech capabilities for a price that can't be beat!

XMC for Xact motion control

XMC controllers utilize the EtherCAT high-performance protocol which is specifically designed for real-time communication and deterministic data exchange, making it ideal for precise motion control applications.

XMC for EtherCAT Xpansion

XMC controllers feature full EtherCAT Master capabilities, meaning they can communicate with and/or control any EtherCAT device including EtherCAT I/O, encoders, AC drives, etc.

XMC for Xtensive automation

Not only can XMC controllers handle numerous EtherCAT devices, they also support G-code, M-code, and programming specific to robot control including Delta3, Delta3R, Linear Delta, and more.

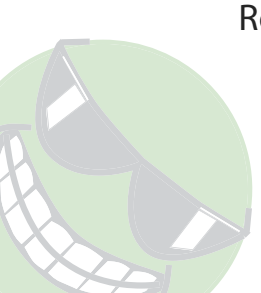
XMC for blazing fast Xecution

The XMC controllers offer extremely fast processing capabilities, with a scan time of 6.25ns for basic commands, 5ns for motion commands, and 30ns for arithmetic commands. EtherCAT-based high-speed communication cycle times are 0.5/1/2/4ms.

XMC for Xtreme value

The XMC controller provides both highly advanced motion control with EtherCAT communication and built-in PLC functionality for a price well below the competition. By using the powerful XMC controller for your next motion control application, you could save thousands on hardware costs alone, not to mention the FREE software and support!

Research, price, buy at: www.automationdirect.com/motion-control



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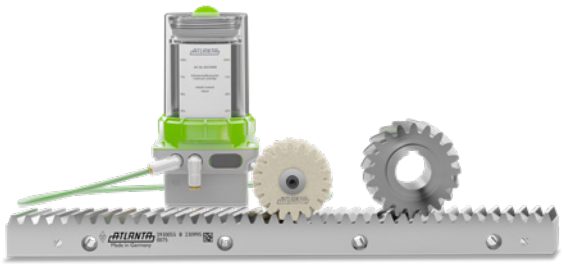

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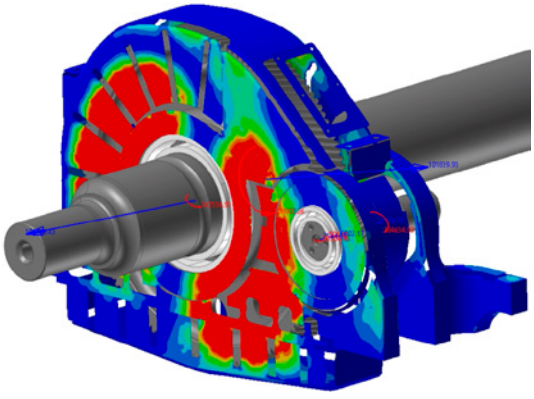

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PTE™

VOL. 19, NO. 7

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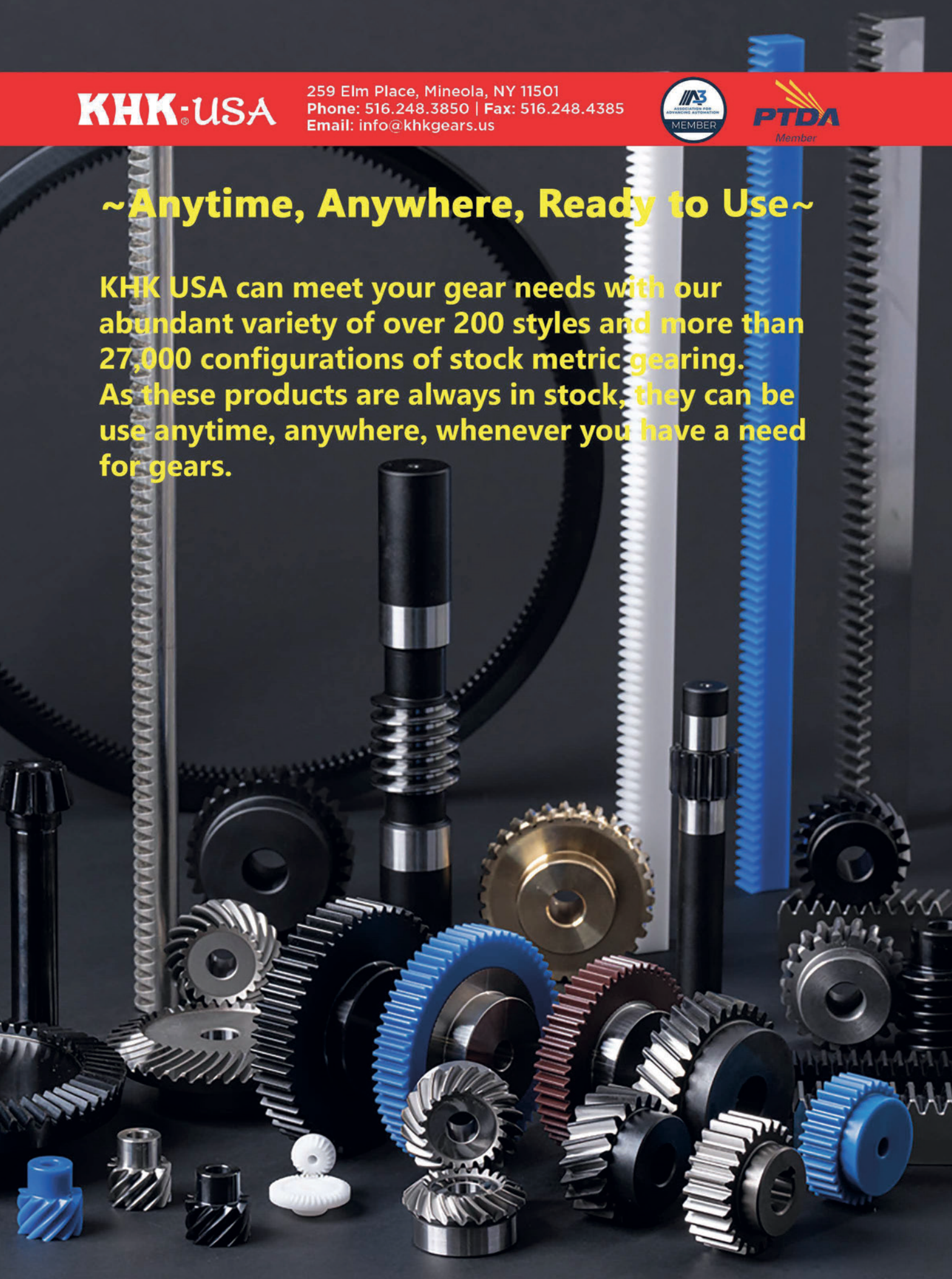


PTE REVOLUTIONS

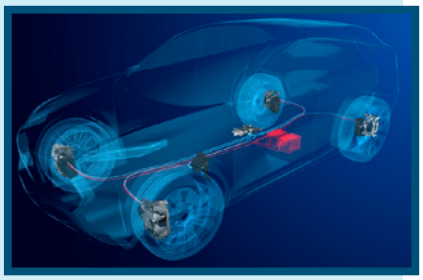
DBS Transform Reduces Time to Reverse Engineer Gearboxes

Gearboxes are engineered to endure challenging environments and operate for extended lifespans. However, over time, circumstances can change, prompting end users to seek support from providers other than the original manufacturer. This need arises due to various reasons, such as the original manufacturer going out of business or persistent performance issues with the gearbox.

powertransmission.com/dbs-transform-reduces-time-to-reverse-engineer-gearboxes

ZF Brings to Market a Comprehensive Brake-by-Wire Portfolio

ZF has a long history as a developer and manufacturer of braking systems worldwide. More than 3 billion ZF brake components have been produced over the past 50 years, ensuring driving safety around the globe. Even in the age of software-defined, fully networked and electrified vehicles, a car cannot operate safely without powerful and fail-safe brakes.



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From a small, rented space with a single machine to a reputable force in heavy industry, Rapid Gear's story is as much about resilience as it is about engineering excellence. Founded nearly five decades ago by Julian and Ana Sabados, Rapid Gear is more than a gear manufacturer—it's a testament to the power of hard work, determination, and a willingness to adapt to the needs of an ever-evolving industry.

geartechnology.com/built-to-last

powertransmission.com

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Last-Ditch Effort

MPT Expo takes place this month (October 21–23 in Detroit).
If you haven't signed up yet, now is the time. Here's a free pass. Please register.

The experts in the world of mechanical power transmission will be gathering in one building for a few days. You may think you don't have time. You can't get out of the office. You can't afford to travel.

But can you afford to miss it?

The world is changing. Fast. If your supply chain isn't under stress due to tariffs, global unrest or political upheaval, it will be soon. We've heard from many manufacturers who are panicked. Even those that thought they were safe—those with stable, U.S.-based supply chains—have now begun to realize that the tariffs are going to affect them, too, as bigger players are scooping up all available resources. If your steel prices haven't gone up, they will. If your delivery times haven't increased significantly, they will.

And the rules keep changing every day.

If only there were someplace you could go to find alternative suppliers of things like gears, bearings and gearboxes. Or even suppliers of the machines, tooling and software required to make those components yourself.

Oh yeah. There is such a place. It's called MPT Expo.

And not only is it the best place to find solutions to your supply chain problems, it's also a great place to network with and learn from your peers in the industry. Find out what everyone else is doing and return home with ideas that can help you navigate the chaos.

motionpowerexpo.com

PTE

Randy Stott
Publisher & Editor-in-Chief

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The U.S. Department of Energy reports that HVACR systems account for as much as 40 percent of energy use in commercial buildings, with space heating, cooling and ventilation driving most of the consumption. This makes energy efficiency a top priority for facility managers and OEMs alike. ABB, a NEMA motor manufacturer, engineered the Baldor-Reliance GNEM motor solution to answer this need.

The Baldor-Reliance GNEM motor is engineered to meet the diverse needs of industrial applications worldwide. These motors offer a unique combination of global compatibility, energy efficiency and robust construction, making them an ideal choice for original equipment manufacturers (OEMs) and end users operating across international markets.

"ABB recognized that facility teams around the world needed a smarter approach to managing HVACR systems and general-purpose applications, so our team engineered the Baldor-Reliance GNEM motor to meet this demand," said Bevan Christiansen, global segment manager-air handling, ABB. "By unifying multiple applications into one global platform, GNEM provides a larger return on investment for OEMs and facility managers."

The GNEM motor is a high-performance, durable solution optimized for variable speed drive applications. With dual frequency support and a broad tri-voltage range, it operates seamlessly across a wide range of configurations without modifications.

The motor supports NEMA frame sizes from 56 to 286T, covering broad system requirements, enabling users to simplify inventory with a universal solution that meets diverse operational requirements across global markets. Available in rugged rolled steel or durable cast-iron frames, and with a choice of open drip proof (ODP) (IP22) or totally enclosed fan cooled (TEFC) (IP44) enclosures, GNEM motors offer flexibility, reliability and long service life.

Key features include:

- Global compatibility: Designed to operate seamlessly on both 50 Hz and 60 Hz power supplies, GNEM motors support tri-voltage configurations (208–230/460V at 60 Hz and 190/380V at 50 Hz), ensuring adaptability across diverse regions and power systems
- Wide power range: Available in power ratings from 1 to 20 horsepower, covering NEMA frame sizes 56 through 286T, to suit a broad spectrum of industrial applications
- Construction options: Offered in both ODP and TEFC enclosures, in general purpose or HVACR (shaft grounded) configurations, with rugged cast iron frames built to withstand demanding operating conditions
- Energy efficiency: Compliant with global Minimum Energy Performance Standards (MEPS) including NEMA Premium efficiency (IE3), ensuring energy savings, lower operating costs and environmental compliance in both domestic and international markets
- Inverter ready: GNEM motors are designed for use with variable speed drives. HVACR models are available with a factory-installed shaft grounding brush to help mitigate bearing currents and extend motor life under inverter-duty operation
- Certifications: CE, CSA and UL Recognized (UR) certifications support global acceptance and ensure compliance with key safety and regulatory standards

Its universal design reduces the number of stock-keeping units (SKUs) needed by supporting a wide range of applications under a single part number. This simplifies maintenance, speeds repair periods, increases uptime and streamlines sourcing, allowing facilities to reduce both cost and complexity.

abb.com

SEW-EURODRIVE

Offers External Lubrication Systems for Heavy Industry Gearing

SEW Eurodrive now offers external oil cooling and supply systems for heavy industry gearing with lead times as short as six weeks. Built and configured at SEW-Eurodrive Heavy Industry Gearing (HIG) in Wellford,

Continental
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www.continental-industry.com

SC, these systems are engineered to support today's torque-dense gearboxes—where thermal limitations often determine gearbox size.

Previously available only through longer-lead global channels, these systems are now stocked and assembled in the U.S., eliminating delivery bottlenecks.

Never Lose Your Cool: Precision Cooling for Critical Applications

As HIG drive systems grow more compact and power-dense, thermal management becomes essential. SEW Eurodrive's external lubrication systems address that challenge, with configurations that ensure oil is delivered, circulated, and cooled exactly as your application demands.

Available types include:

- Oil-to-air cooling systems (OAP1)
- Oil-to-water cooling systems (OWP1)
- Pressure lubrication systems without cooling (ONP1)

Each is sized using SEW Eurodrive's thermal validation tools and can be gearbox-mounted or skid mounted for flexibility in layout and maintenance access.

What's New

- Assembled in the U.S., reducing delivery time from 14–20 weeks to as little as 6 weeks
- Standard options in stock and ready to configure
- Designed to support thicker startup oil viscosities up to 5,000 cSt

Built for Your Application

SEW Eurodrive's Oil Cooling and Supply Systems can be tailored to your specific requirements and include modular, sensor-ready features to support system reliability and monitoring. Standard stocked options include:

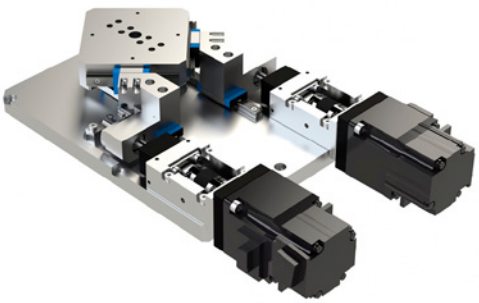
- Duplex oil filters (25 µm)—allows filter change during operation
- Electro-optical contamination pop-up indicator
- Oil manometer gauge
- Oil thermometer gauge
- Oil pressure switch
- Oil temperature switch—all to monitor the gearbox oil sump in real time

"With local assembly and standard stocked components, we can now deliver complete external thermal management solutions in six weeks—helping our customers get their HIG systems up and running faster and more reliably," said Austin Burdette, product manager, SEW Eurodrive HIG USA.

seweurodrive.com

IKO INTERNATIONAL

X-Y Stage Features Unique Parallel Drive Configuration



IKO International has introduced the PD...S X-Y parallel drive stage that removes the barriers that often exist in the work area during equipment design. With the PD...S, machine designers can achieve highly accurate positioning without sacrificing workability and performance.

Unlike typical X-Y stages layered with one-shaft actuators that make access from the outside difficult due to cables and moving motors close to the stage, the PD...S is

designed with a mechanism that converts the ball screw actuator's linear motion into X-Y motion via two parallel shafts. With two motors arranged in one direction, the PD...S creates an open, accessible work area for easy, flexible designs and customizations—all in a lightweight, compact unit with low sectional height.

Along with X-Y motion, the stage can also provide diagonal and circular motion. Precision is assured for every operation thanks to the PD...S's integrated maintenance-free IKO C-Lube ML Linear Motion Rolling Guide.

ikont.com

TIMKEN BELTS

Releases Banded Version of The Energy Saver

This banded version of "The Energy Saver" combines the longer life and superior performance of the Gold-Ribbon Cog-Belt with the stability of a banded belt. It provides excellent service life in harsh environments and high shock load conditions. The unique construction combines the superior flexing of precision molded cogs with the tenacious gripping power of raw edge sidewalls. Gold-Ribbon Cog-Band is designed to achieve longer belt life, higher efficiency and higher horsepower ratings. It's an ideal choice for applications where increased horsepower or speed is required. The reinforced band across the top of two or more individual v-belts greatly enhances stability by preventing the belt from turning over or jumping off the drive.

Features include:

- Minimizes belt whip and rollover on long center distance drives
- Precision molded cogs
- Superior flexibility with reduced bending stress dissipates heat providing longer belt life
- Raw edge sidewalls produce a higher coefficient of friction reducing slippage
- Improved performance and efficiency
- Highly engineered tie-band permanently bonds or "ties" multiple belts together enabling belts to function as a single unit with even load distribution and wear
- Vibration is dampened
- Heavy shock loads are absorbed

Applications for the Gold-Ribbon Cog-Band Belts include blowers, fans, pumps and more.

timkenbelts.com

VESCONITE

Offers Hilube Bushings for Roper Gear Pumps

A supplier of premium products and services to the oil and gas service industry has repeated purchases of Vesconite Hilube bushings for Roper gear pumps, following the bushings' successful in-field performance on the pumps' drive and the driven (idler) gear shafts.

The company initially tested Vesconite Hilube bushings in November 2022. These were introduced as an alternative to the standard bronze bushings typically fitted to Roper gear pumps. Following a promising performance, the client returned with an order for 10 additional sets in July 2024 and again in March 2025 with

a further 12 sets. "They seem to be holding up better than the bronze bushings they came with," confirms a company spokesperson.

Roper gear pumps, manufactured in the United States, are widely used to pump high-viscosity fluids, such as bitumen, molasses, and resins—all known for their challenging flow characteristics and abrasive properties.

Vesconite Bearings technical representative Juan van Wyk notes that repeat orders are a key indicator of performance satisfaction.

vesconite.com

FORCE CONTROL

MagnaShear Motor Brakes Enhance Safety

The MagnaShear motor brake from Force Control Industries employ oil shear technology which transmits torque between lubricated surfaces—thereby eliminating the heat build-up of dry brakes which is a major source of conveyor fires. A patented fluid recirculation system dissipates the heat and keeps these proven brakes running cool. Totally enclosed MagnaShear brakes are impervious to moisture, dirt, and dust—further enhancing their safety. In addition to being safer, oil shear technology eliminates wear on friction surfaces, significantly increasing service life and virtually eliminating adjustment in demanding mining and bulk materials handling applications.

In addition to conveyors, MagnaShear motor brakes are ideal for applications where the motor is reversed each cycle such as loader/unloader conveyors, as well as cranes, winches, and hoists, rail car spotters and dumpers, rotary samplers, trippers, and pallet return conveyors.

The oil shear technology also provides a smooth "cushioned" stop which reduces shock to the drive system, further extending service life of downstream components.

Unlike dry brakes, oil shear technology includes a layer of automatic transmission fluid between the brake disc and the drive plate. As the fluid is compressed, the fluid molecules shear—thus imparting torque to the other side. This torque transmission causes the stationary surface to turn, bringing it up to the same relative speed as the moving surface. Since most of the work is done by the fluid particles in shear, wear is virtually eliminated. Elimination of wear also eliminates the need for adjustments which are common for dry braking systems.

In addition to transmitting torque, a patented fluid recirculation system helps to dissipate heat which is the major problem with traditional dry brakes.

Along with heat removal and torque transmission, the fluid serves to continually lubricate all components of the oil shear brake, elongating their service life.

MagnaShear brakes with oil shear technology provide significantly longer service life, characterized by virtually maintenance-free operations.

These proven motor brakes are available to accommodate a wide range of applications. Spring set torque ratings from three to 1,250 ft-lbs are available. MagnaShear motor brakes can be sized to the correct torque independent of the motor frame size or horsepower.

MagnaShear motor brakes feature "quick mount" features for quick and easy mounting to drive motors in NEMA frame sizes 56 to 449. They are shipped ready to install, with no assembly or adjustments required. They are also available pre-mounted on a motor for severe duty applications. MagnaShear motor brakes can be furnished to fit a NEMA or IEC frame motor, as a complete motor and brake assembly, or to mount on a machine frame or other special mounting configuration.

These proven motor brakes are totally enclosed from outside contaminants, with seal integrity for harsh and washdown environments. A modular design/assembly allows for ease of servicing and maintenance.

forcecontrol.com

TRAFAG

Highlights Industrial Pressure Transmitter for High-Performance Sensing in Rugged Hydraulic Applications

Trafag highlights the NAT 8252 Industrial Pressure Transmitter, designed to meet the rigorous demands of hydraulic systems. With its ultra-compact design, fully welded stainless steel construction, and broad customization options, the NAT 8252 delivers a powerful combination of performance, reliability, and adaptability for hydraulic needs.

Engineered with Trafag's robust thin-film-on-steel sensing technology, the NAT 8252 ensures stable and precise pressure measurement over time, critical for hydraulic operations. Its excellent long-term stability reduces the need for recalibration, lowering operational costs and maintenance burdens. A wide measuring range, from 0 to 700 bar (0 to 10,000 psi), allows it to serve applications from low-pressure pilot lines to high-pressure main circuits.

Designed for extreme conditions, the NAT 8252 offers a completely welded steel sensor system free from internal seals, providing excellent durability and eliminates leakage risks, ensuring robust performance

even in hydraulic circuits exposed to aggressive fluids and high pressures. It is available with triple or optional five-fold overpressure protection, safeguarding both sensor integrity and system reliability during hydraulic pressure spikes and surges, which enhances system reliability and extends equipment lifespan.

For space-constrained hydraulic installations, the NAT 8252's minimal footprint enables seamless integration into compact hydraulic manifolds and control panels, maximizing valuable installation space in high-density environments. Multiple electrical and pressure connection options make it easy to adapt the transmitter to existing hydraulic system layouts and industry standards. Compatibility is further enhanced by a variety of output signals for hydraulic controllers and monitoring systems, along with an optional one- or two-channel PNP switching output for integrated control and monitoring which adds flexibility to system design.

Rated for use in demanding hydraulic environments, the NAT 8252 features IP65, IP67, or IP68 ingress protection, ensuring dependable operation in challenging hydraulic environments, and withstands temperatures from −40°C to +125°C. The robust design also withstands harsh mechanical and environmental conditions commonly encountered in hydraulic machinery and mobile hydraulics. Its rapid 1 ms response time ensures real-time accuracy in dynamic hydraulic processes, while built-in EMC and reverse polarity protection enhance operational safety and installation resilience.

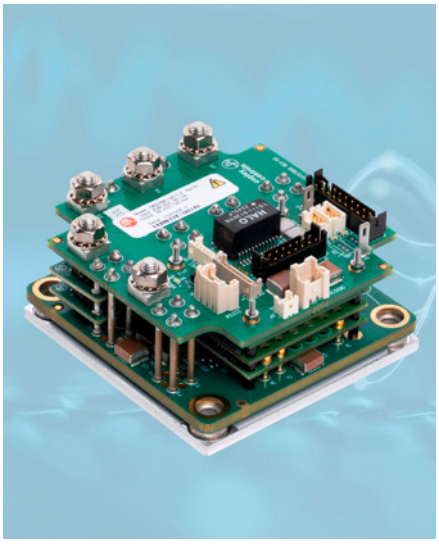
The transmitter also boasts a high accuracy of ±0.5 percent FS typ. at 25°C, ensuring precise pressure measurement, essential for safe and efficient hydraulic system operation.

Offering Trafag's most extensive customization options, the NAT 8252 is the go-to solution for durable, compact, and high-performance pressure sensing technology in the hydraulics industry, adapting to virtually any hydraulic application.

trafag.com/en/nat-8252-industrial-pressure-transmitter

COPLEY CONTROLS

Releases High-Power Nano Servo Drives For Mobile Robotics



Copley Controls recently announced the release of its Nano High Power (Nano HP) and Nano Plus High Power (Plus-HP) digital servo drives for brush and brushless motors.

Both series expand Copley's compact Nano family and feature redesigned power boards for higher current output, making them ideal for traction motor applications in autonomous mobile robots (AMR), automated guided vehicles (AGV) and other space-limited mobile robotics requiring higher-power embedded modules.

The Nano HP is based on Copley's Nano Standard platform with ARM processor, while the Nano Plus-HP is built on the advanced Nano Plus platform with FPGA-based architecture for enhanced functionalities. Both drives operate from 9 to 90V DC input voltage and deliver up to 140A of continuous current, providing exceptional power density and efficiency. They also support EtherCAT (CoE) and CANopen communication protocols for real-time data exchange, with the Plus-HP supporting additional networking protocol options.

Additional features and specifications include:

- Safe Torque Off (STO) capability with SIL 3, Category 3, PL e conformance.
- One analog input: ±10V, 12-bit (HP) / 16-bit (Plus-HP).
- 16-kHz current loop update.
- 4-kHz position and velocity loop update.
- Five high-speed digital inputs.
- Four high-speed digital outputs, including brake.
- Multiple encoder interfaces—incremental, absolute, dual feedback and digital halls.
- 32-bit floating point filters and multiple advanced filters.
- Frequency analysis tools.

Nano HP and Plus-HP drives are designed to meet the requirements of many mobile robotics applications, AGVs, AMRs and field robotics. Standard modules can be implemented using connectors or by soldering power pins for high load current applications, while the Z-style modules' small form factor facilitates integration with standard connectors and a frame-mounted heat plate.

copleycontrols.com

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Detailed Information
www.cti-symposium.world

A History of Motion + Power

MPT Expo celebrates gear and power transmission innovation

Matthew Jaster, Senior Editor

The first Gear Expo featured 22 exhibitors at the 1986 Fall Technical Meeting in Chicago. It was billed as the "AGMA Fall Technical Meeting & Gearing Exhibition" and provided attendees the opportunity to learn the latest technical advances, state of gear research and gear design. The show highlighted machine tool, software and processing exhibitors to meet the ever-changing needs of the gear industry.

The original plan was to hold the Exposition annually, so the following year saw a giant bump from 22 to 130+ exhibitors in Cincinnati in 1987. Nearly 1,200 people from 39 U.S. states and 16 foreign countries attended the Expo. The most talked about feature was the live machinery on the show floor—attendees didn't just receive a sales pitch as they walked the exhibit hall, they could see the latest gear manufacturing technology live and in-person, a huge draw for years to come.

"Welcome to Gear Expo 1987. As you can see by looking around you, the need to create a show exclusively for the gear industry was a real one. We felt that the industry deserved its own marketplace to demonstrate its new technology under one roof," said Joe Arvin, president, Arrow Gear and chairman of the AGMA's Product Division in 1987.

After the 1987 Gear Expo, the AGMA decided to make the show a biennial event—taking place in a variety of cities across the Midwest every other year.

AGMA's Gear Expo 1989 came with a tagline, "The Cutting Edge." The show opened at the David Lawrence Convention Center in Pittsburgh, PA. This year's show was dubbed "the largest trade show ever conceived specifically for the gear industry." The show was 60 percent larger in terms of floor space and offered gear manufacturers and suppliers to the gear industry a specialized forum to display their products. Among the products and services on display were grinders, hobbers, cutting tools, shapers, milling machines, testing equipment, filtration, lubricants, broaching machines and heat treating. The 1989 Gear Expo featured an 1850s era, working gear cutting machine courtesy of the E. Gould & Company.

The 1991 Gear Expo took place in Detroit with the tagline, "The World of Gearing" with topics on 3D contact analysis, gear tooth friction, gear stress distribution, oil jet gear lubrication and low-noise marine gears. *Gear*

Technology had a booth along with American Pfauter, American Oerlikon, Fellows Corporation, Klingelnberg and Bourn & Koch to name a few. By this time, technical papers and FTM presentations were proving advantageous to all attendees.

"As they have since our founding, technical standards continue to be the glue that holds several hundred companies and individuals together for our common and mutual good and the spark that opens doors to new opportunities for AGMA and the gear industry," said AGMA President Joe Franklin in the 1993 September/October issue of the *AGMA News Digest*.

AGMA was changing strategies to expand globally. In general, gear demand significantly increased between 1992 and 1998. By 1997, AGMA was exhibiting at the International Power Transmission and Control Show in Hannover, Germany and had begun attending Eurotrans meetings across Europe.

The 1999 Gear Expo selected Nashville as the host city long before the rest of the world flocked to Tennessee for bachelorette parties or the vibrant secret music scene. The 1999 Gear Expo displayed the latest gear machine technology but also focused on the latest metalworking processes found across manufacturing. This hinted at the changing needs of shop floors. Job shops were taking orders for open gearing as well as providing components for full systems.

"One of the reasons AGMA has been successful over our 95-year history is that the association's agenda, programs and activities reflect the voice of our members. The board of directors, advisory committees and councils and the staff vigilantly review programs and vet them with members for needed changes, updates or cancellation. The organization today is much changed from what it was in 1987, a decade ago, even a year ago," Franklin said in 2011.

A Collaborative Future

New content for the 2005 show in Detroit included the Gear Expo Solutions Center, an on-floor educational exhibit where companies could give 20-minute presentations free to attendees. The Forging Industry Association and Forging Defense Manufacturing Consortium also presented a seminar on "Gear Forging Solutions," and the ABMA held a seminar on "Bearing Design and Application." Other industries were coming to Gear Expo and putting a greater emphasis on technologies and processes to enhance gear and power transmission applications.

In 2009, AGMA began holding Gear Expo in conjunction with the ASM Heat Treating Society Conference and Exposition. The U.S. Department of Commerce selected Gear Expo for certification as one of its International Buyer Trade Shows that year. Embassies around the world encouraged their commercial officers to bring interested delegations to Gear Expo. The Indianapolis show featured an international center on-site with representatives from the U.S. Commercial Service to help exhibitors and attendees benefit from increased exports of products represented at the show.

As the 2015 show opened its doors in Detroit, Gear Expo aimed to cover the entire gear system—from pre-production to end users. The tagline "Drive Technology Show" hinted at these subtle changes. This very magazine, *Gear Technology*, used 30+ pages of its September/October issue to take an in-depth look at the technology displayed on the show floor. This included everything from power skiving and gear cutting technologies to analytical gear inspection and new coating and tooling strategies.

Motion + Power Potential

AGMA was now ready to move into the next chapter with its biennial trade show. Gear Expo transformed into the Motion + Power Technology Expo for the 2019 show in Detroit. The tagline "Gear, Electric, Fluid Power: Moving the Future," brought the latest demands for efficiency and power density

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front and center and added mechanical, fluid power, electric and hybrid technologies to the mix. This was no longer a show just about gears, this was a show about how these markets were rapidly changing with electrification, automation, additive manufacturing and robotic technologies.

"The event has evolved into the Motion + Power Technology Expo, becoming much more than just a trade show. MPT Expo has grown into a one-stop educational, networking and buying event, and it's expanding its reach into other types of power transmission products as well," said *Gear Technology* Publisher Michael Goldstein at the time. "The business track will include topics such as cybersecurity, supply chain and workforce development, while the emerging technology track will include seminars on 3D printing, electric drives, IIoT and robotics."

The 2023 show in Detroit kept both the gear and power transmission sectors informed on the latest information on gear design, heat treating, electric vehicles, automation for job shops, workforce development and future insights into where these industries were heading.

"MPT Expo was truly where the gears were and we were pleased with the attendance and all the events that were part of this great show," said Matthew E. Croson, president, AGMA. "Detroit is a great town for MPT Expo and drew the quality of attendee for which we are known."

Editors Note: Material for this article was provided by past issues of *Gear Technology*, *PTE* and "Celebrating 100 Years of Gearing."

In April 2025, AGMA/ABMA membership voted to approve a merger between the American Gear Manufacturers Association (AGMA) and the American Bearing Manufacturers Association (ABMA), creating the Motion + Power Manufacturers Alliance (MPMA). The new organizational structure began on May 1, 2025.

The MPMA will deliver increased value through standards creation under the AGMA and ABMA brands, more robust education and workforce development programs, a strong connection of the supply chain via face-to-face events, two industry publications, and advocacy at the Federal government.

"The creation of the MPMA comes at a crucial time in our industry, where we are seeing a growth in gearing and bearing sales, and a consolidation of the companies that create these mechanical power solutions," said Sara Zimmerman, MPMA chair and vice president of customer experience and product, Sumitomo Machinery Corporation of America. "I look forward to working closely with Vice Chair Matt Frady from Dodge Industrial, and the entire board of directors as we forge a new path for this dynamic industry."

The Motion + Power Technology Expo 2025 is doubling down on these efforts. MPT Expo will feature more than 150 of the world's leading gear companies, machine tool suppliers, and electric drive solutions providers, including Timken Power Systems, Meritor, EMAG LLC, Gleason Corporation, Kapp Group, Nidec Machine Tool America and others. Attendees will see manufacturing processes and experience the latest product technologies and machine demonstrations firsthand.

Think Big, Not Safe

The evolution of the Motion + Power Technology Expo is noteworthy. The show and its diverse team of talent has come a long way from 22 tabletop exhibits at the FTM in Chicago back in 1986. The Expo has made a strong case for innovation and expansion by focusing on gear and PT systems. Technology and industry growth will always be the show's focal point.

Gear Technology's former resident author summed it up best in an article about the changes facing companies involved in gears, bearings, motors, etc.

"Many wonderful opportunities are coming in alternative energy, environmental remediation, electric vehicles and infrastructure revitalization. Think big, not safe. When challenged, get the team together and brainstorm ways to reach that price point, to make that deadline, to figure out new ways to accomplish a better result. Don't settle for being the last vendor standing in a dying market segment," stated Charles Schultz, from a blog on the *Gear Technology* website.

motionpowerexpo.com

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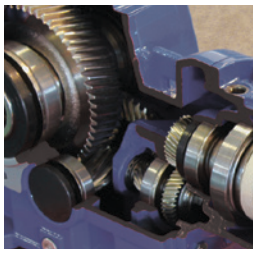

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Pack Expo Las Vegas 2025

Celebrates packaging and material handling solutions

Matthew Jaster, Senior Editor

Pack Expo Las Vegas, one of North America's most comprehensive packaging and processing events is celebrating a milestone: 2025 marks 30 years since the show's debut. Today, Pack Expo Las Vegas continues to be a global hub for industry innovation and collaboration. Show producer PMMI, The Association for Packaging and Processing Technologies, has elevated Pack Expo Las Vegas from a regional trade show to a global industry force—expanding its scale, influence, and relevance across international markets. This year, the show spanned over 1 million net square feet, featuring 2,300+ exhibitors.

"Pack Expo Las Vegas has always been more than a trade show—it's where the future of packaging and processing takes shape," said Jim Pittas, president and CEO, PMMI. "For 30 years, we've been proud to drive innovation, foster collaboration, and spotlight the technologies shaping tomorrow's supply chains. As we look ahead, we remain focused on the forces transforming our industry: automation, AI, sustainability, and workforce development."

The following booths featured technology relevant to the *PTE* audience:

Reliability and Versatility with Nord
Booth #SU-20098

Nord's packaging solutions focus on reliability, versatility, and efficiency. With over 20,000,000 standard configurations to choose from, Nord delivers precisely configured drive systems for end-of-line packaging applications, such as pick-and-place, labeling, filling, sealing, wrapping, strapping, and palletizing machines. The comprehensive product portfolio also includes a wide range of options for general conveyance between packaging steps, with optional safety features like soft start, brake ramps, and STO functions to protect workers, equipment, and products.

Performance optimized Nordbloc.1 gear units deliver high efficiency with low operating costs. Made from high strength, lightweight aluminum alloy, these units are ideal for packaging systems as they reliably handle high axial and radial loads and provide a long service life with minimal maintenance. Nordbloc.1 gear units are extremely versatile, with helical inline, helical bevel, single-stage helical, and two-stage helical bevel gear options available. They also offer various shaft options, mounting options, and application-specific versions available for precise system adaptation.

Thanks to their modular design and high-power density, Nord Universal SI/SMI worm gear units can be quickly and easily adapted to a wide variety of applications. Reinforced bearings enable the worm drives to absorb large axial forces from pouch sorter applications while their compact design optimizes space utilization. While SI gear units have an open housing for better heat dissipation, SMI gear units are available as a smooth surface for easy cleaning in hygienic areas. Both series also offer various configuration options including hollow or solid shafts, shaft-, flange-, or foot-mounted versions, and NEMA, IEC, or direct motor mounting options.

Compact and highly efficient, NORD IE5+ synchronous motors achieve significant energy savings, reduce operating costs, and provide a fast ROI. The extremely efficient operation is possible thanks to the use of permanent magnets which eliminate the need for an external energy supply to generate the magnetic field, additionally enabling high power density and a higher maximum achievable torque. Unlike asynchronous motors, IE5+ motors deliver constant torque and efficiency over a wide speed range, even during partial load operation and at low speeds, allowing for system variants to be minimized. The motors additionally are available as a smooth surface design for hygienic environments (TENV) and a finned version for optimized heat dissipation in heavy traffic systems (TEFC).

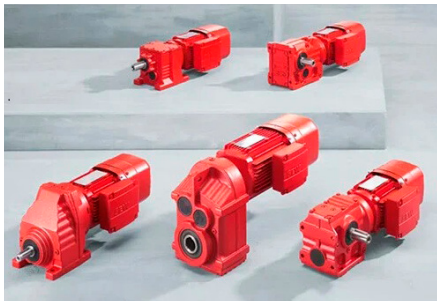
`nord.com`

Reliable Automation and Motion Control Solutions with SEW-Eurodrive
Booth #34041

As a leading provider of drive and automation solutions, SEW-Eurodrive is dedicated to supporting manufacturers and OEMs with advanced, reliable, and sustainable technologies for food and beverage production and packaging and logistics machinery.

The increasing demand for sustainable and healthy food poses new challenges for manufacturers in the food industry. Production processes need to be adapted, and innovations are needed to meet industry-specific trends such as new flavors, changed dietary preferences, and sustainability, namely energy efficiency and seamless traceability of resources. All this with a focus on hygienic

production and the highest quality standards. The efficient use of modern technologies is crucial to remain competitive. With its efficient and holistic drive and automation solutions, SEW-Eurodrive supports its customers in the food industry with their requirements and goals in being able to process raw materials into food quickly and efficiently.



The beverage industry is about much more than just quenching thirst. There is a huge selection of different drinks in a wide variety of containers. What this diversity has in common are the requirements for product quality, availability and, increasingly, sustainability.

The decisive factor here is, of course, the production process, from process technology to filling and packaging, as well as the conveyor technology as the connecting element between the process steps. For all these steps, we offer you our many years of expertise in the beverage industry, not only as a machine manufacturer, but also as a beverage manufacturer.

This gives you the security of having a reliable partner at your side who will support you with the right drive and service solutions throughout the entire life cycle. In concrete terms, this means that you have a contact partner who takes care of your needs—no matter when and where—so that quality, availability and sustainability are always guaranteed.

Changing market requirements and new demands facing food producers in terms of packaging represent a challenge for manufacturers of packaging machines. They have to design ever faster and with even greater flexibility, while at the same time facing an increasing shortage of skilled workers. This is only possible with a strong partner who offers the right solutions and services for complex drive and control technology.

seweurodrive.com

Kuka Demonstrates Automation and Robotic Technologies

Booth #3444

Automation demonstrations took place between KUKA System Partners FOCUS Integration, DGT, Automated Automation and Blue Onyx Systems (formerly named Viking Masek Packaging Technologies). The live demonstrations included autonomous mobile robot (AMR) solutions for intralogistics, robotic palletizing/depalletizing, a robotic case packing operation and a conveyor picking and handling system. The company also be featured its newest technology—the KR C5 Kuka industrial robot controller for enhanced flexibility and performance, and the *iiQKA.OS2 Kuka System Software* (KSS) for workflow optimization.

Kuka System Partner FOCUS Integration demonstrated standard palletizing and depalletizing with its fenceless CUBE robotic palletizing cell paired with a KMP 600P AMR. FOCUS Integration's CUBE cell is equipped with its FOS next-generation solution of tools, including a 22" Multitouch glass screen, GuardLogix safety controllers and Ignition Vision for reducing the learning curve for new operators. The KMP 600P is part of Kuka's latest generation of AMRs for Logistics 4.0 and features intelligence, safety, and easy commissioning to navigate complex, dynamic environments with the simultaneous localization and mapping (SLAM) navigation method. The AMR platform automatically identifies loads with QR code readers, and 3D cameras detect obstacles in three-dimensional spaces. It can transport up to 600 kg and is particularly suitable for compact production environments.

Kuka System Partner DGT used a KR Iontec robot to demonstrate automated product picking and packing with its case packing cell, which is designed to pack products of any shape or size. The cell's custom-made grippers ensure accurate product gripping and loading and are equipped with a KR Iontec that has a maximum reach of 2,101 mm and a rated payload of 70 kg that can subsequently be adjusted even after mounting. The KR Iontec provides users the highest output with a low total cost of ownership and high life cycle efficiency.

The KR Iontec family of robots is an extremely versatile six-axis medium payload robot that can be floor, wall, ceiling, or angle mounted, and its optimized design is well-suited to compact cells with a small footprint. Boasting a best-in-class work envelope and equipped with waterproof and dustproof in-line wrist and protected motors, the KR Iontec is suitable for virtually any application. The Hygienic Oil (HO) variant of the KR IONTEC uses food-compatible H1 oil in all axes to eliminate the potential for contamination in the food processing and manufacturing sectors.

Kuka's KR Cybertech HO robot was on display through Kuka System Partner Blue Onyx and equipped with a 3D vision system from Sick Sensor Intelligence for full 3D scanning and measurement using intelligent 3D cameras. The display involved automated conveyor picking and placing of oddly shaped objects into trays or bins.

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Leveling Up Lubrication

KM Specialty Pumps help increase lubrication improvements with SKF Lincoln SL–6

Matthew Jaster, Senior Editor

The SL-6 provides several design improvements for heavy duty applications.

The SKF Lincoln SL-6 metering device is a single-line automatic lubrication system injector. Its proven design is thoroughly updated to meet new demands on maintainability, leakage-protection and long-lasting performance even with harsh extreme pressure greases. Today's manufacturing environment demands less maintenance time, higher productivity demands and little to no tolerance for unplanned production stops.

The end game with an automatic lubrication system is increased productivity. These systems make sure lubricants constantly flow to bearings, pins and bushings. They lubricate machines while in motion, overcoming loads and allowing grease to protect all wear surfaces. The broad output range makes the SL-6 a suitable replacement for injectors with different outputs and the standard dimensions.

Regardless of the application, the principle of single-line lubrication remains the same: a central pump station that automatically delivers lubricants through a single supply line to the lubricant metering device. Each metering device serves only one lubrication point and may be adjusted to deliver the precise amount of grease or oil required. They can be retrofitted to existing applications.

Systems can service one machine, different zones on one machine or even several separate machines. Applications include machine tools, automation, printing machines, on/off-road vehicles, construction and forestry machines, cement industry, food and beverage, rail, steel and more.

Turnkey Systems and Solutions

According to Devin Allen, director of lubrication, KM Specialty Pumps designs, engineers, sales, installs and services SKF Lincoln automated lubrication systems for all types of heavy equipment (ie) "Yellow Iron" including mining equipment such as large draglines and haul trucks, and not to mention railroad track lubrication systems. KM also provides complete turnkey lubrication systems for the pulp and paper, steel, aluminum and the food and beverage industries.

"The SL-6 eliminates the need to connect 3 SL-1 injectors to obtain output required for large bearings and bushing," said Allen. "This leads to adjustability improvements, quicker repairs and less downtime."

The benefit of this lubrication system is reduced risk of leakage with improved sealing technology, reducing the risk of bypass. In the unlikely event of failure, the closed design leads bypass lubricant to the bearing. Additionally, there is an interchange ability with SKF Lincoln SL1 and SLV Injectors.

"The broad range of output makes the SL-6 a suitable replacement for injectors with different outputs and the standard dimensions and connections make it easy to fit into an existing system," Allen added.

In the future, Allen would like to see a smaller version of the SL-6 that would replace the SL-32 injector.

SKF Advantages

The SL-6 provides increased performance thanks in part to a new slide valve design and heat-treated stainless-steel construction which increases life significantly with mining greases. The simpler measuring chamber design decreases size, weight and failure modes. A patented quick venting feature of the SL-6 (and SLV) ensures large systems vent even during cold weather.

"We've made several design improvements over Lincoln's quick venting injector," said Bret McCawley, district manager, SKF.

Notably, there's a 360-degree view high visibility indicator pin that makes it easy and obvious to ensure proper function. There's also significant weight reduction by replacing two models with the SL-6—cutting service part inventory in half.

One design change enhancing productivity is the ability to monitor the equipment from far away. "Engineers can easily and quickly see injectors functioning from a safe distance depending on the equipment," McCawley said.

Service and support is provided by SKF's tech service team and application engineering team. "We can size installs correctly, provide consultation and our teams have access to a vast distribution network—KM Specialty Pumps, for example," McCawley said.

Lubrication continues to become more important as the equipment evolves with the trend of more end users

The Right Lubrication Management Program

The facts are simple—less lubricant is better for the environment. Also, an optimally lubricated machine is more energy efficient, with reduced leakage, friction and reduced noise levels. A lubrication solution that can meet environmental demands, as well as extend machine uptime and service intervals for higher productivity is optimal today.

SKF offers a lubrication management program to determine that the right lubricant is provided, in the right quantity, to the right point, and at the right time. With SKF Lubrication management tools, the company can calculate return on investment and discuss lubrication needs.

Common issues in lubrication management are:

Lubricant contamination

Lubricant chemical degradation

Wrong lubricant selection

Insufficient or misleading knowledge

The SKF Lubrication Management program helps prevent these issues—while obtaining reduced costs for labor, unwanted downtime and energy—and spares consumption. Through a structured process, customers can build a lubrication program in five steps:

1. SKF Client Needs Analysis - Lubrication Management

A one-day assessment: SKF consultants will conduct a first assessment in your facilities, to assess the level of maturity of your lubrication program and define the path to follow. This is normally a one-day activity.

2. SKF Lubrication Audit

A one-week assessment: When the level of complexity of the facility is high—or if you have already implemented basic improvements towards a world-class lubrication—a thorough assessment is advised. This is normally a one-week activity.

3. Improvement proposal

Once the required information in gathered, SKF will propose specific activities that will help improve the lubrication program in place—according to your specific goals.

4. Design and implementation

Once discussed and agreed upon, SKF can support you in the implementation of the improvement proposals.

5. Optimization

In order to measure the effectiveness of the program, a reassessment is advised. This usually reveals additional improvement opportunities that will help you close in on your goals.

Consistent lubrication is vital to the life of bearings, gears and chains. Like any mechanical system, moving parts in a food and beverage plant need proper lubrication to function optimally. Contamination, moisture, high temperatures and humidity are all threats to bearing, chain and gear service life. Failure to properly lubricate each lubrication point on every machine can have a negative impact on schedules, maintenance costs and machine performance. Poor lubrication causes about 36 percent of all premature bearing failures, but with the right lubrication solution you can create new opportunities to increase uptime and productivity.

Automatic lubrication systems supply the correct amount of grease at the best time to lubricate—while the bearing is in motion. Frequent lubrication maintains the proper lubricant film to reduce wear, as well as purges the pins and bushings of contaminants.

Friction and wear occur across the entire delivery chain. Efficient lubrication is critical for each rotating machine component, and chains and conveyors need special treatment. Independent from your final product, SKF lubrication solutions support all moving parts in your machines. SKF offers a complete selection of high-performance progressive, single-line, dual-line and chain lubrication systems for the food and beverage industry, which are tailored to the customer's specific requirements.

going to automated systems, McCawley added. "SKF will continue to be a leader in the automatic lubrication space by innovating new products such as the SL-6 and maintaining our product lines."

Allen emphasized that the MRO space in manufacturing is constantly evolving.

"It's changing mining, mineral processing, construction and heavy industry. These market segments are finding it increasingly difficult to retain or fill machinery lubrication positions. This is where specialized lubrication companies such as KM Specialty find a growing market for their turnkey lubrication systems," said Allen. "Providing a turnkey system for the application along with the specification of lubricants is very important for maintaining a reliable operation for any industry."

(Additional information for this article was provided by James Verseman, product manager, and Brad Edler, engineering manager)

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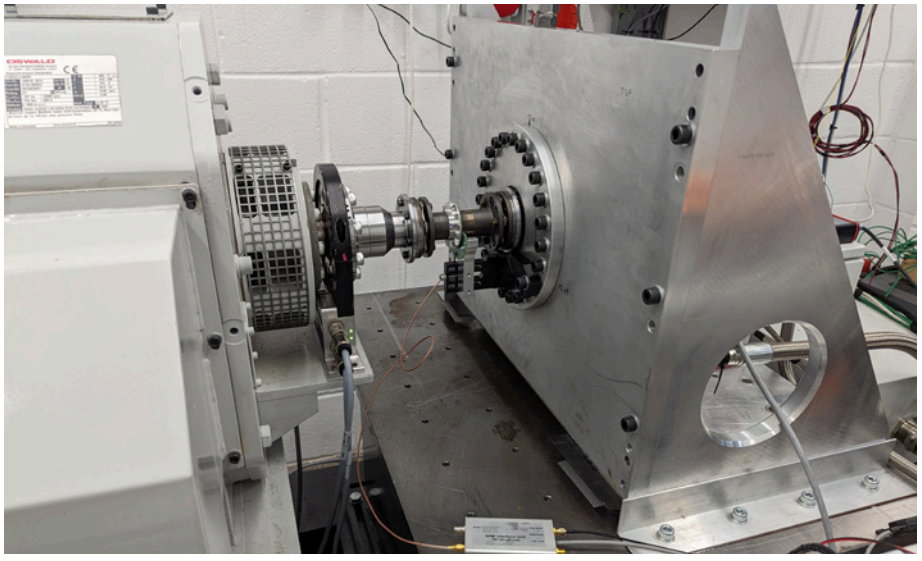
PTE

Unlocking Powertrain Density with Motor Control

Drive System Design and Transense Technologies collaborate on fully functional automotive solutions

Matthew Jaster, Senior Editor

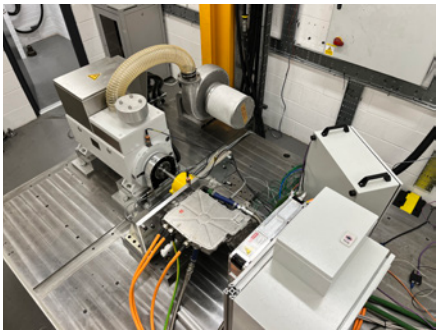


DSD and Transense Technologies collaborated on a motor control study on high-speed, high power density traction.

An innovative technology for the next generation of high-speed, high power density traction and propulsion systems has been jointly developed by Drive System Design (DSD) and Transense Technologies. David Hind, principal engineer, DSD, presented "Unlocking Powertrain Power Density with Innovative Motor Control," earlier this year at the CTI USA Symposium 2025 in Novi, MI. The presentation built on initial simulation studies performed in MATLAB Simulink; a software tool used to design and simulate systems before moving to hardware. While simulation trials proved successful, achieving quality experimental results proved far more challenging. Hind examined these challenges and potential solutions at CTI.

Hind said in a recent interview that the growing trend towards high-speed motors as a means of increasing power density is limited by the computation time of the motor control algorithm which has been identified as a key a limiting factor in the maximum achievable motor speed.

Direct Torque Control (DTC) has a much lower computational burden than the commonly used Field Oriented Control approach and can reduce execution time by >50 percent, enabling control at higher motor speeds.



However, DTC suffers from torque accuracy and ripple because of the torque and flux estimators used and the interdependence between the two. An Improved DTC approach was proposed using measured torque feedback in place of the torque estimator. This approach eliminates the interdependency between the estimators and can significantly reduce torque ripple.

Surface Acoustic Wave Torque Sensor

DSD has experience in motor control solutions. "We've developed our own platform in-house and we're able to develop custom controls," Hind explained. "Recently, we developed a new type of motor control with Transense Technologies."

Founded in 1991, Transense Technologies, headquartered in the UK, is a leader in the development and supply of specialized sensor technology and measurement solutions for use in demanding, high growth markets. Transense created a sensor for the accurate measurement of torque, pressure and temperature based on Surface Acoustic Wave (SAW) technology.

"Transense created a really neat torque sensor, and they were looking for new market opportunities, particularly in automotive, so they came to us to help find new innovative ways to utilize the sensor," Hind said.

This technology is a wireless, passive, sensing system consisting of three main elements: SAW sensing elements connected to antennas known as RF Couplers mounted on the part to be measured and an electronic interrogation unit called a

reader, connected to its stationary RF coupler. The reader generates and transmits an interrogation signal across the RF Coupler to the sensing element. The sensing element is excited by this RF signal creating a surface acoustic wave on the surface of a piezoelectric substrate between the fingers of an interdigital transducer (IDT). The IDT reflects the SAW back to the reader. The frequency of this reflected signal is affected by the physical measurement of either strain or temperature in the sensing element. The reader analyses the received signal and calculates the value of the physical measurement.

"The sensor has a small package envelope requirement and is suitable for integration into mass produced motors, meaning the technique can be applied in production EDU's and propulsion systems. DTC also removes the requirement for a position sensor (for algorithm implementation at least) which offers the potential to offset the BOM cost of the torque sensor," Hind said. "Our job was to find more value in the technology so we identified a solution that would help to increase powertrain power density using motor control."

Motor Control Enhancements

The Improved DTC approach was verified using a DSD dynamometer and test motor featuring a SAW sensor integrated into the mechanical coupling between the two motors. According to Hind, significant challenges around torque ripple feedback required additional measures to avoid this ripple being injected into the control via the closed loop.

DSD's Open Platform Inverter is utilized to interface to the SAW sensor and demonstrate the newly developed Improved DTC algorithm. Hind shared these developments in his presentation along with results from the verification testing as well as the challenges affecting the practical implementation of this new motor control approach. The presentation provided real insight into the development testing that has taken place by including the challenges faced in achieving a fully functional solution.

"One of the trends we see in motor and drive units today is increasing speeds with increasing pole counts and that allows the motors to be physically smaller. But of course, this can introduce problems for other parts of the system—one of those being the motor controls. When you push those motor speeds faster you are squashing the time you have to do the calculations to control the motor. The algorithm we produced with Transense can be executed really fast, so you can keep pushing the speed up without hitting the ceiling of the calculation time," Hind said.

They were also able to demonstrate this on a rig using DSD's in-house facilities. "We're really spoiled here. We have several test rigs where we can evaluate this equipment in real-time," Hind added.

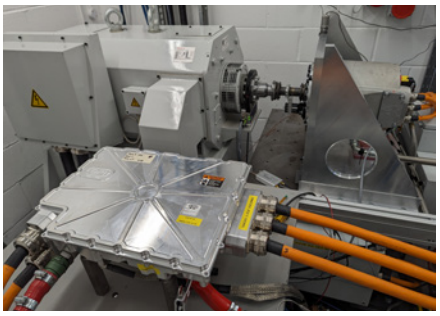
Trial & Error

Hind believes the most challenging aspect of motor control is getting something to work in both the physical and simulation space. "Simulation makes life a lot easier," he said. "The signals are always very clean. You can add noise into the signals if you want, but you are always in charge of what that noise looks like. It is when you get to the real world where it doesn't always work out."

With one algorithm, one of the problems Hind found was the dynamics of the torque feedback into the closed loop system interacting with the external systems. The dynamometer played a role in interacting with the sensor and adding an element of feedback they had not accounted for in the simulation.

"There are one or two other things in there—like bearing loss and windage loss—and those can add up to make a meaningful contribution. This made it difficult during our first attempt, but we were able to find a solution by improving the sensor implementation and where it fed into the algorithm. There is always an element of trial and error at this point," Hind remarked.

Hind credits the engineers and the equipment available to them with



making the job of refining and fixing various problems much easier. "As I mentioned earlier, our in-house test facility really helps solve the challenges associated with motor control. We also have several experienced engineers we can call on to provide feedback and different points of view on the research. This is invaluable to the work we do at DSD."

The Research Continues

Hind said the direct torque control algorithms DSD developed do not use many standard control methods like field-oriented control. "This allows you to reach those higher speeds. Typically field oriented control has an eight to 10 microsecond execution time. This is what we see without doing a load of optimization on the code—which is very time consuming itself and costly as a result."

People tend to move over to something called six step at high speed, also called 120 degrees commutation or trapezoidal control. It uses six steps or "sectors" over one electrical cycle to energize a BLDC motor. Each sector is equivalent to 60 electrical degrees, with the six sectors resulting in 360 electrical degrees or one electrical cycle. "This is a basic modulation scheme, and is poor in terms of the output quality. What we are trying to do is provide a control approach that gives the customer higher quality without the execution time penalty," Hind said.

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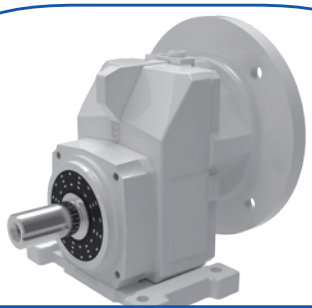

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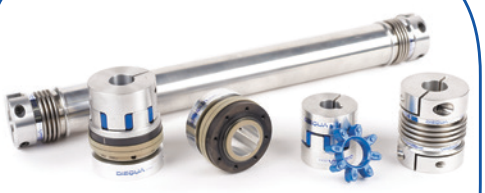

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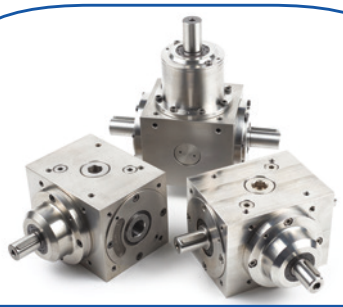

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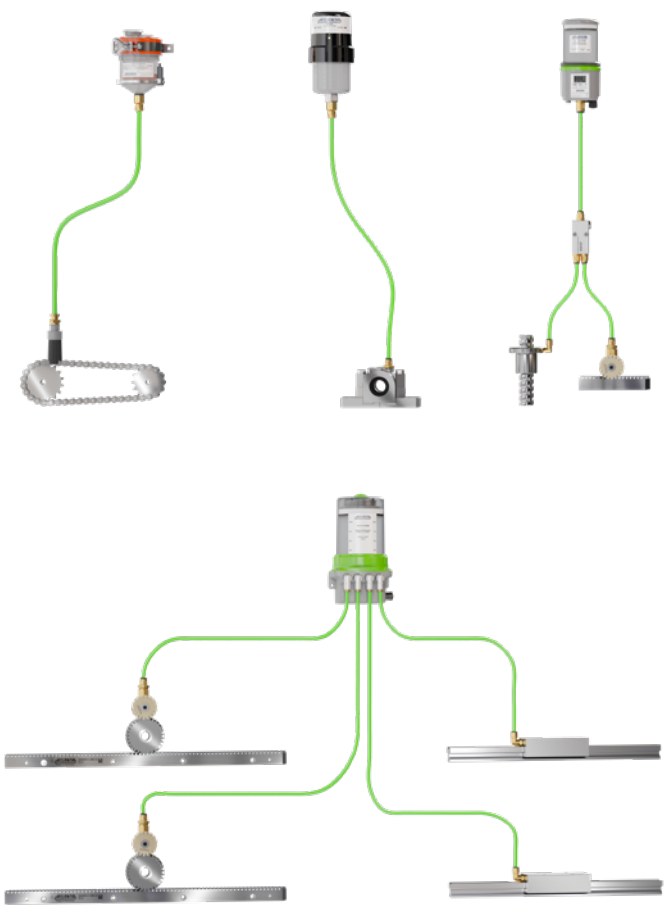
The Advantages of Automatic Lubrication Systems

Atlanta Drive Systems examines grease vs. oils, single point vs. multi point strategies and the evolution of lubrication technology

Matthew Jaster, Senior Editor



Whether single-point or multi-point lubrication, customers increase the performance of their machines and systems with a permanent and controlled supply of the necessary lubricant.

Atlanta Drive Systems, Inc., Farmingdale, NJ, offers rack and pinion systems, actuators, gearboxes, servo reducers and lubrication systems for many different industries including machine tool, automation, aerospace, woodworking, material handling, robotic, food, packaging, stone and special machinery. *PTE* recently discussed the company's lubrication solutions with Peter Alfano, senior applications engineer.

Why is a reliable lubrication system so critical to open gearing applications?

Trustworthy and reliable lubrication systems are critical to ensure the life of open gearing primarily to prevent metal-on-metal contact. A proper layer of lubricant is required to reduce friction while increasing allowable loading and prevents premature wear of the contact surfaces. Lack of lubrication may result in loss of precision due to wear and the eventual failure of the gearing if it is not maintained.

Describe the differences between manual and automatic lubrication systems. What are the key advantages of an automatic lubrication system?

Manual application of lubricant can be effective in some cases, but it can be unreliable. The maintenance schedule of the system may not always coincide with when the system requires additional lubrication. This may result in messy over lubrication and other times of inadequate under lubrication. This is especially true if the location is difficult to access. Using an automatic system provides the advantage of a steady and uniform supply of lubricant. Automatic systems are typically sized with an appropriate volume to not require service for 12+ months.

Automatic systems have changed from basic self-contained electro-chemical or electro-mechanical systems to more advanced versions featuring multiple outlets, multiple pumps and PLC integration.

How is lubrication technology evolving in manufacturing today?

Lubrication technology is evolving largely through dispensing methods. The automatic systems have changed from basic self-contained electro-chemical or electro-mechanical systems to more advanced versions featuring multiple outlets, multiple pumps and with PLC integration.

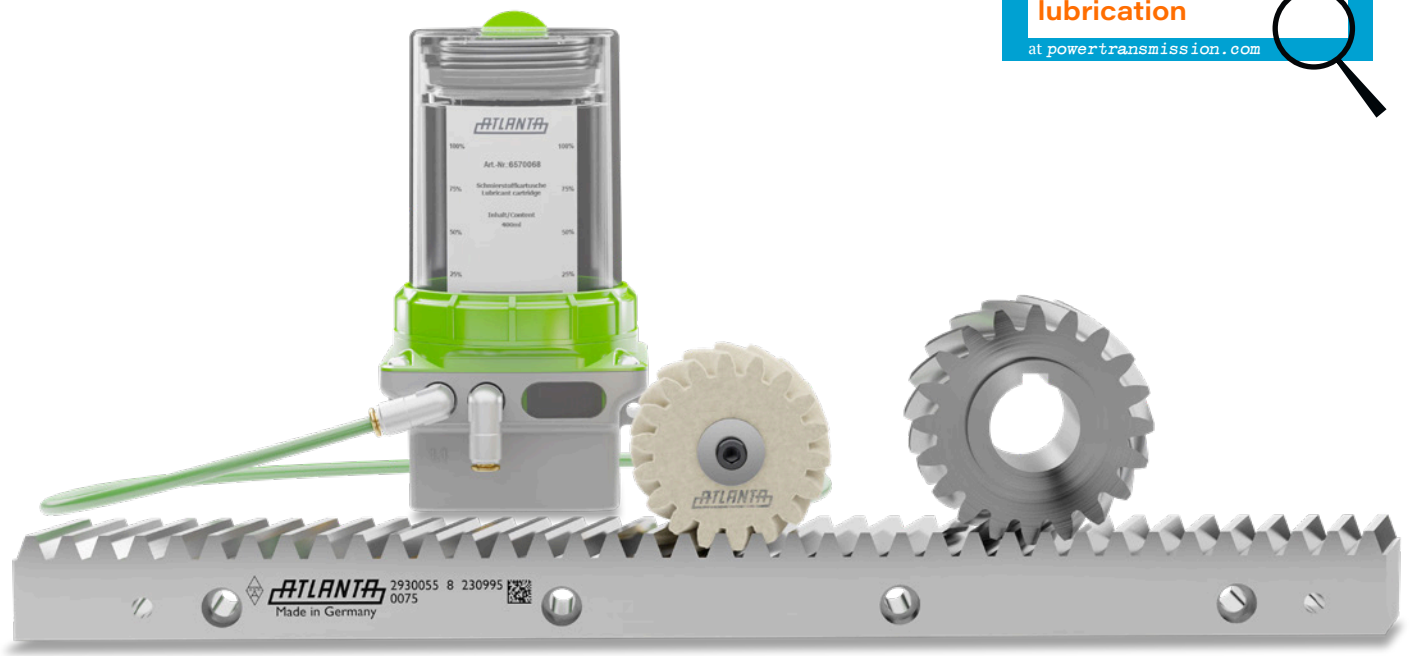
What do your lubrication experts recommend between selecting greases or oils? What are the advantages/ disadvantages of both options?

We recommend NLGI 0 (very soft) or 00 (semi-fluid) grease. This consistency range works for many open gearing applications because of the balance between flowing freely through any accessory components for distribution while also staying in place once applied. Oils are not ideal for open gearing because they are more likely to flow resulting in more mess and positionally not enough surface coverage.

Give our readers some insight into single point and multi point lubrication strategies and discuss functions, applications and benefits for each system.

Every system has unique lubrication challenges so having options to choose from single point or multi-point lubrication is critical.

Single point systems are perfect for when a simple solution is required. They come in a wide range of sizes and generally they are more compact compared to multiple-point solutions. Lubrication dosages are straightforward to calculate and adjust when you are dealing with only a



With its precise operation, this lubricator is suitable for automatic lubrication of roller and sliding bearings, gear racks, open gears and more.

single point. This is normally done through DIP switches or an LED display. Power options using batteries or eternal power supplies are available depending on what the system design allows. Single point systems can be electro-chemical or electro-mechanically driven

Multi point systems are ideal for larger systems. They can be used for multiple lubrication points of the same type or different types. Combinations of open gears, chains, bearings, spindles, or linear guides could utilize a multi-point system to reduce the lubrication reservoirs. Multiple outlets and multiple pumps are common features. This allows for variable flow rates for the different lubrication points. Multi point systems typically include more advanced features and optional PLC controls. PLC integration provides feedback on the lubrication unit like low lubrication levels, lubricating pressure, and pump errors. This feedback is valuable for identifying issues between regular maintenance. Power options using batteries or eternal power supplies are available, but most are externally powered in our experience. These systems are generally mechanically driven and operate at higher pressures compared to single point systems.

What accessory components/ technologies should customers consider for installation and maintenance of lubrication systems?

Maintenance is fairly straight forward for most automatic lubrication systems. For electro-mechanically driven systems spare lubrication or lubrication cartages are needed. For electro-chemical systems a pressure chamber is also needed. Electro-chemical systems are sometimes cost-effective to the point where the entire lubrication unit can be replaced at the end of its life.

When lubricating open gearing the best additional component to consider is lubrication gear. This is a gear made from felt or a similar absorbent material that lubrication is pumped through. This method ensures even distribution of lubrication across gear teeth. Many varieties of mounting shafts, hoses, splitters, distributors and check valves are available to complete the automatic system.

How should gear customers approach a lubrication strategy in 2025?

The range of automatic systems on the market is very wide. Solutions can be found for any type of application and for any budget. Taking the extra step to account for proper lubrication should be considered by every mechanical system designer using open gearing. Maintaining the life and precision of the gearing can be extremely simple.

How will lubrication systems change in the future?

There have been many advancements in recent years connecting mechanical components to digital technologies. Industry 4.0, for example, focuses on smart manufacturing and an Internet of Things. We could expect there to be continued developments where automatic lubrication systems provide more feedback in real time when combined with feedback from the other machinal components.

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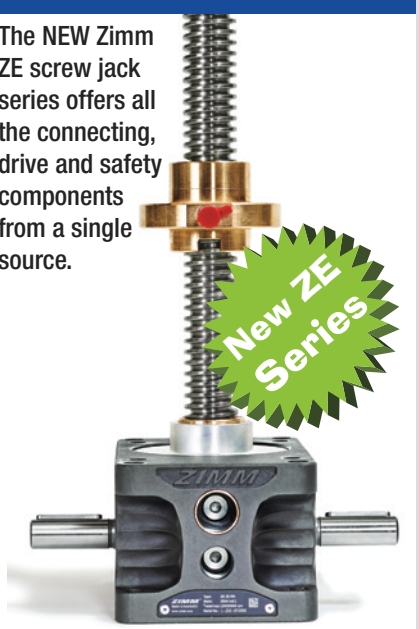

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Tuning Flank Waviness for Minimized Mesh Force Variation

Hanspeter Dinner and Calogero Principato

Objectives

Conventions

In the figures below, blue indicates the designed gear, red the manufactured or measured gear and green the digital twin.

Introduction to the Problem

Loaded tooth contact analysis of gears, considering or neglecting gear misalignment, may be performed by gear design software such as *KISSsoft* or other similar tools. Approximately a dozen such commercial software programs are used in an international environment, most of them based on analytical approaches. Very few are based on FEM approaches. With this, the performance characteristics of a gear design are assessed, considering:

- Transmission error TE and its spectral content.
- Peak to peak transmission error PPTE.
- Contact stress, its maximum value and distribution.
- Gear mesh force variation over a meshing cycle.
- Micropitting and scuffing safety, flank and root strength, considering the calculated load distribution.
- Others.

In principle, it is possible to measure the above performance characteristics also on manufactured gears. Costs in time, equipment and money typically do not allow for this approach in a manufacturing environment. This means that deviations in the geometry of the manufactured gear compared to the designed gear are assessed only in the sense of whether the manufactured gear meets the quality grade stipulated on the manufacturing drawing, e.g., along

Figure 1—Left, designed gear: Assessment of performance parameters such as transmission error, load distribution or strength is possible considering micro geometry, using LTCA. Right, manufactured gear: Assessment of the same performance parameters is practically impossible in a manufacturing environment.

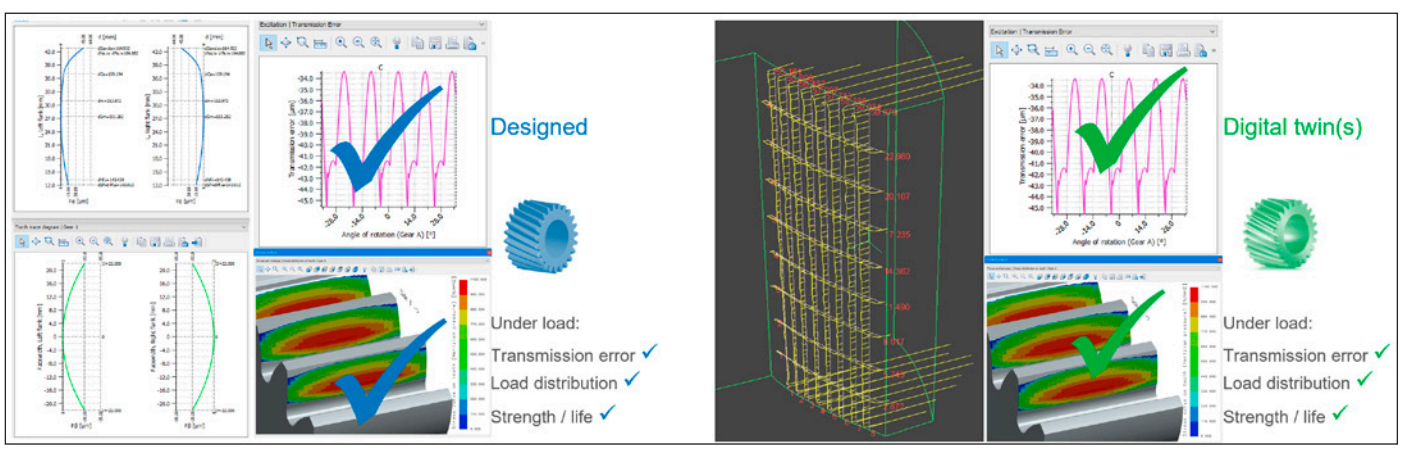

Figure 2—Left, designed gear: Assessment of performance parameters such as transmission error, load distribution or strength is possible considering micro geometry, using LTCA. Right, digital twin gear: Assessment of the same performance parameters is again possible through LTCA.

ISO 1328. But a question "... we manufactured a batch of gears, we measured a form error of xyz µm, is the resulting degradation of gear strength acceptable or do we need to scrap the batch?" cannot be answered.

Closed Loop as Solution

If, however, the manufactured and measured gear geometry could be looped back into the original *KISSsoft* gear design and combined with the designed gear to create a digital twin of the manufactured gear(s), then this twin—or these twins—could be subjected to the same calculations. And the resulting performance characteristics, e.g., contact pressure, may be compared to those of the designed gear. Strength rating methods, e.g., ISO 6336, would then allow for the calculation of gear strength of the manufactured gear and a degradation may be assessed by a gear designer familiar with the requirements. A decision, whether a batch of gears having a geometric deviation needs to be scrapped, is then based on relevant performance characteristics (strength, lifetime, reliability, scuffing safety, etc.), not only on a gear quality number.

The calculation of the above-mentioned performance parameters of the designed gear as the reference and of several gears or batches of gears as manufactured and measured is done in *KISSsoft* through variants of the geometry. This means that simultaneously, several gears are defined in one calculation. All have the same gear macro and micro geometry, but each has a different amount of deviation from the reference gear (of course, the reference gear has zero deviation from itself and is variant No. 1), as measured. This means that in a single calculation file, the reference and as many digital twins as required are managed.

The reference design and the digital twins are then subjected to an LTCA. Transmission error, contact stress levels or contact pattern shape and position of the digital twins are then compared to the results of the designed

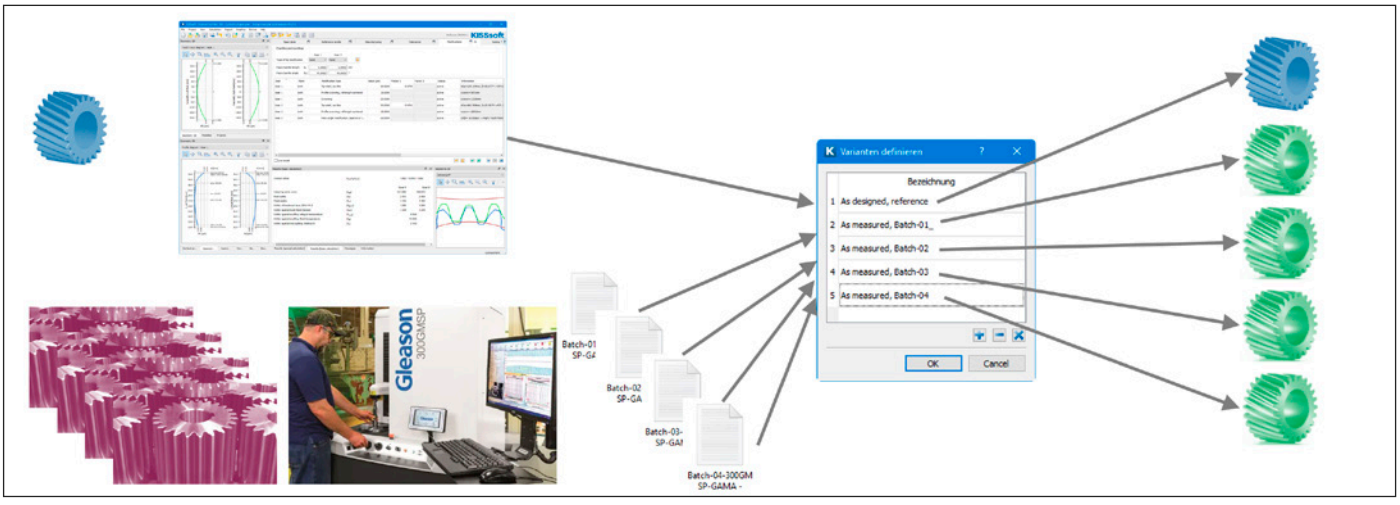

Figure 3—Both the designed gear geometry and several manufactured gears' geometries may be managed simultaneously in software as digital twins, allowing for the calculation of performance parameters and comparison to those of the designed gear.

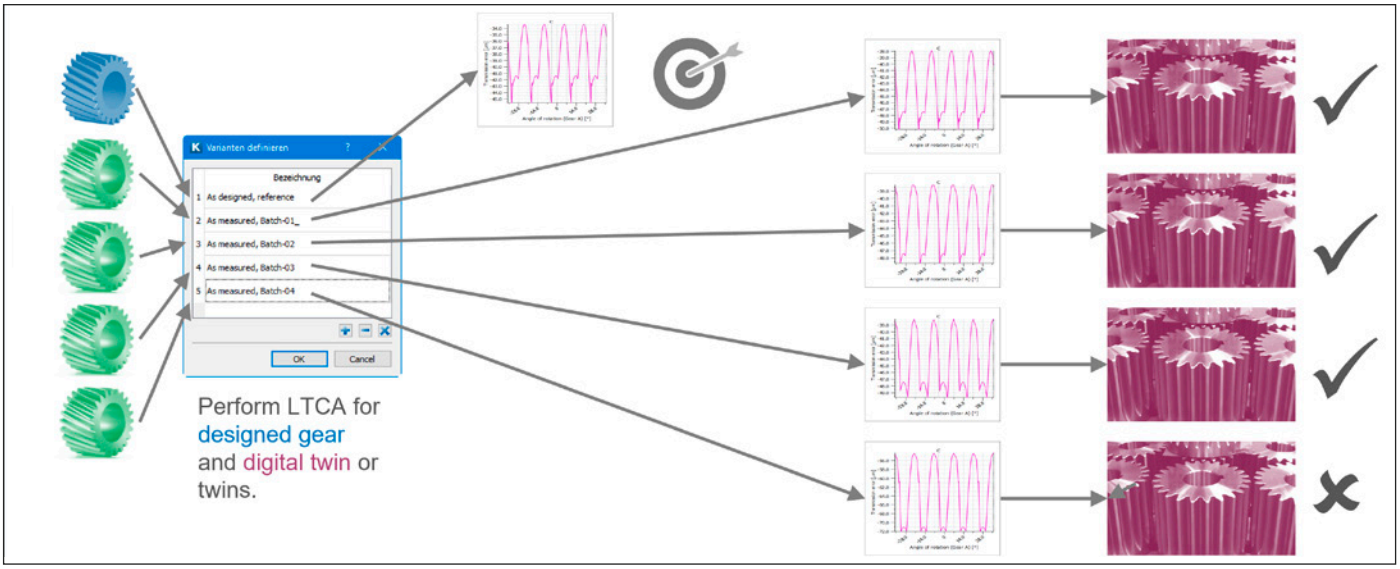

Figure 4—Transmission error TE as a performance parameter. The TE of the designed gear is compared to the TE of the digital twins. If for a digital twin, the TE is found deviating too much from the reference, the manufactured gear (or batch of gears) is scrapped.

gear. If deviations in the performance parameters are within acceptable limits, the gear or batch of gears is approved. If deviations are too high, the gear or batch of gears is rejected. With this approach, quality control is far more target-oriented compared to using only a gear quality number. It also requires more experience to assess the performance characteristics.

Creating the Digital Twin

Measuring a Grid of Points on the Flank as State of the Art

To create a digital twin, it is state of the art to measure a grid of points on the flank, compare their measured coordinates to the coordinates calculated based on the gear macro and micro geometry, and feed the deviations back to the designed gear to convert it to a digital twin. This approach has been available for some time. The gear macro geometry, as designed in the gear design software, is exported as a Gleason *GAMA* software-compatible file or through GDE format, along with VDI/VDE 2610 guideline. Furthermore, direct export and import of a grid of points (rather than their coordinates and normal vector) from *KISSsoft* to *GAMA* is available.

With this approach, the gear measurement machine knows the grid, the grid point designed coordinates and the grid point normal vectors. The measurement of the as-is coordinates of these points is then performed using

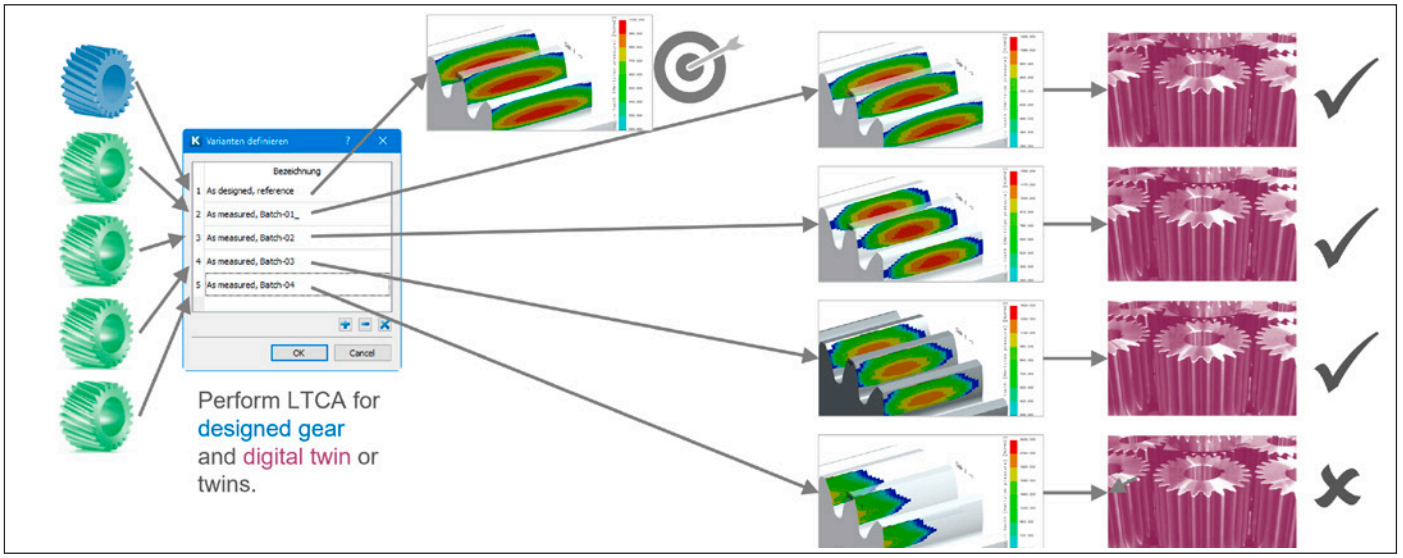

Figure 5—Contact pressure or contact pattern as a performance parameter. The contact stress level and shape of the contact pattern of the designed gear are compared to one of the digital twins. If for a digital twin, the contact pattern is found to be unacceptable when compared to the designed gear, the manufactured gear (or batch of gears) is scrapped.

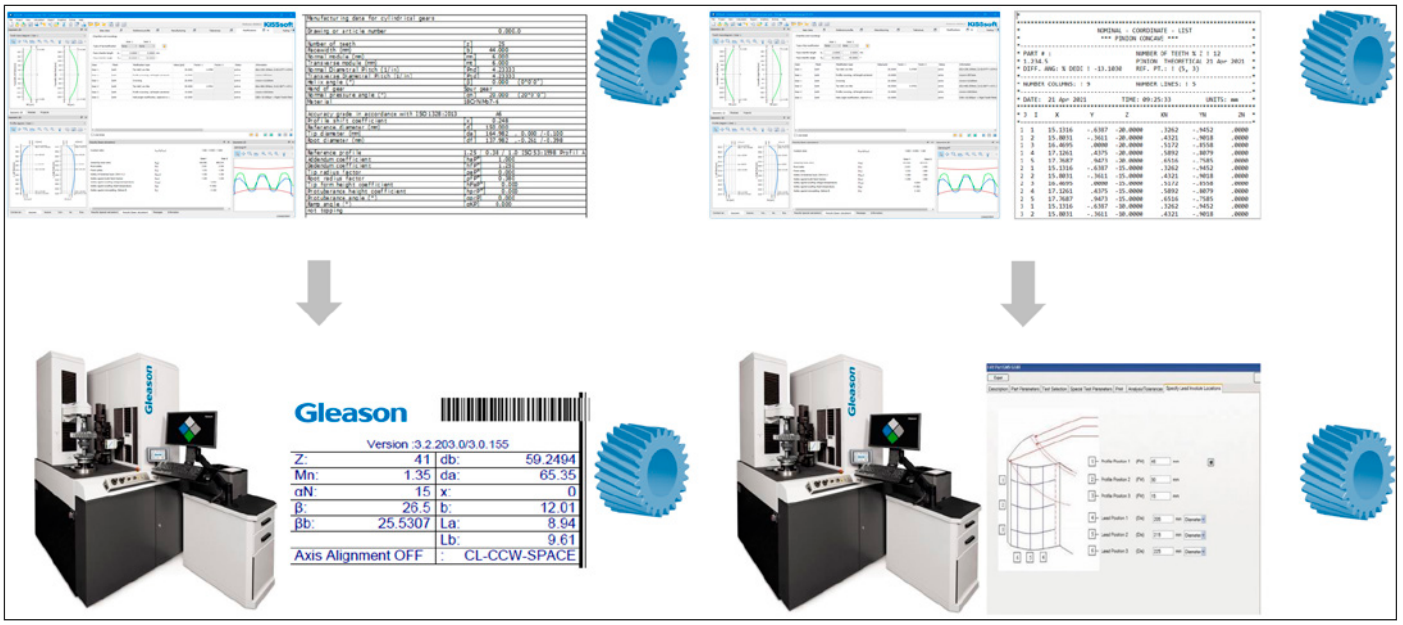

Figure 6—Top: Only gear macrogeometry is transferred from gear design software **KISSsoft** *to* **GAMA** *gear measurement software. Bottom: Both gear macro- and microgeometries are transferred.*

a tactile probe. In Figure 7, the grid indicated consists of 8 × 8 points (green dots). The output is then an 8 × 8 table showing the deviation of the measured grid point coordinates from the designed grid point coordinates or rather the deviation as a scalar, to be understood in the direction of the normal vector of the corresponding point. This table is then imported into the design software, where the designed gear is modified by the imported deviation table to generate the digital twin.

Such a digital twin is suitable for the assessment of tooth contact patterns and load distribution on the flank and will already be most helpful to assess manufacturing deviations like errors in pressure angle, helix angle, crowning or twist.

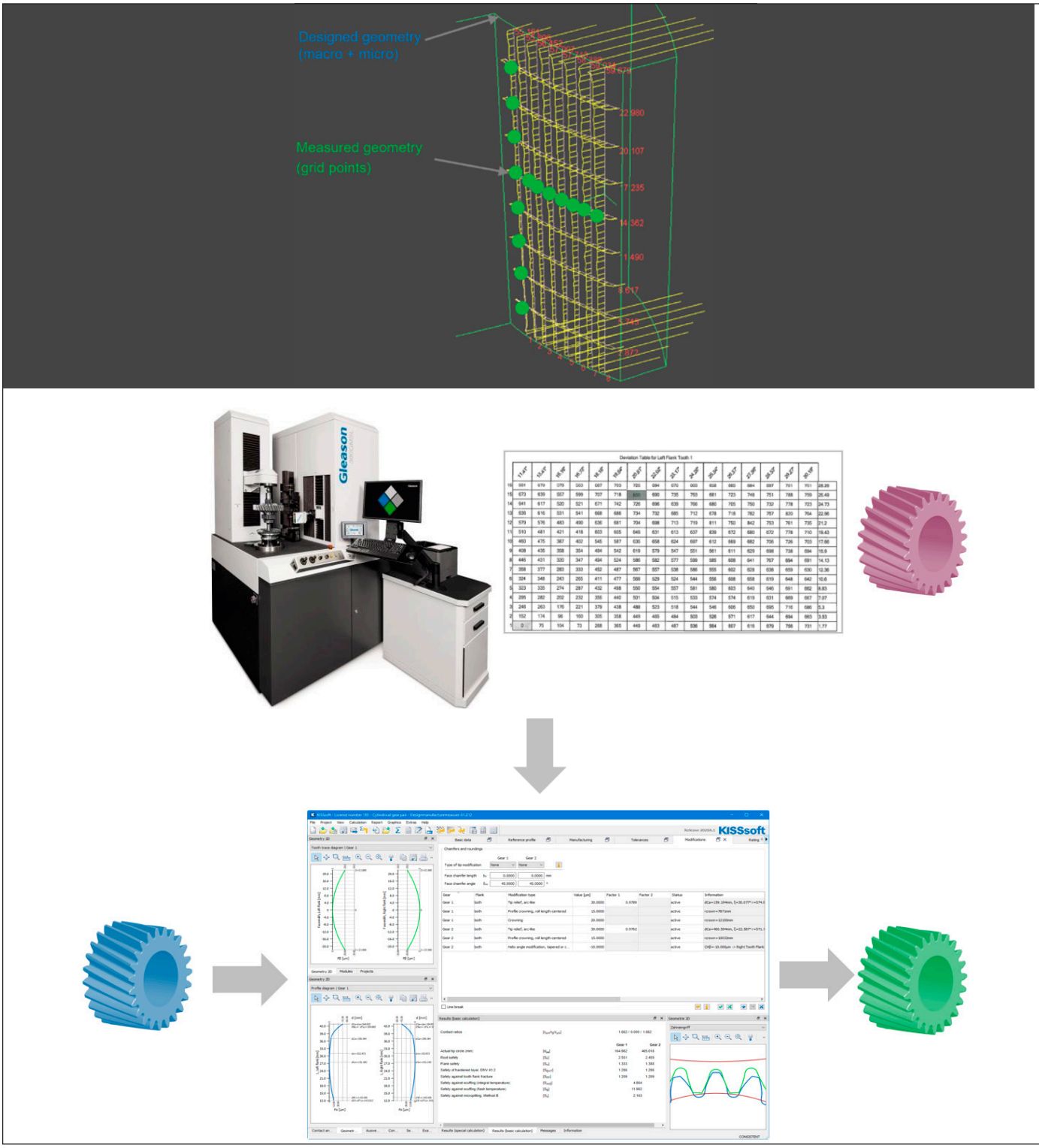

Figure 7—Top: Gear flank is measured on a point grid. Bottom: Deviation from the designed geometry is tabulated in* GAMA *and transferred to* KISSsoft. *There, designed geometry is combined with the deviation to create the digital twin.

Measuring Flank Waviness as Next Step

In the above process, only 8 × 8 = 64 points are measured and the shape of the flank between the measured points is not known. A more refined approach is to not only transfer individual points of information from the measurement but whole traces in lead and profile directions (which is just a much higher number of points). Traces are measured and displayed in Gleason *GAMA* software, see the yellow lines on the left side of Figure 8. These traces show a waviness; they may also be visible in printouts, as shown in the top right of Figure 8. These traces are now to be represented in the gear design software so that the gear model there also includes the waviness as it is present in the manufactured gear. At the time of

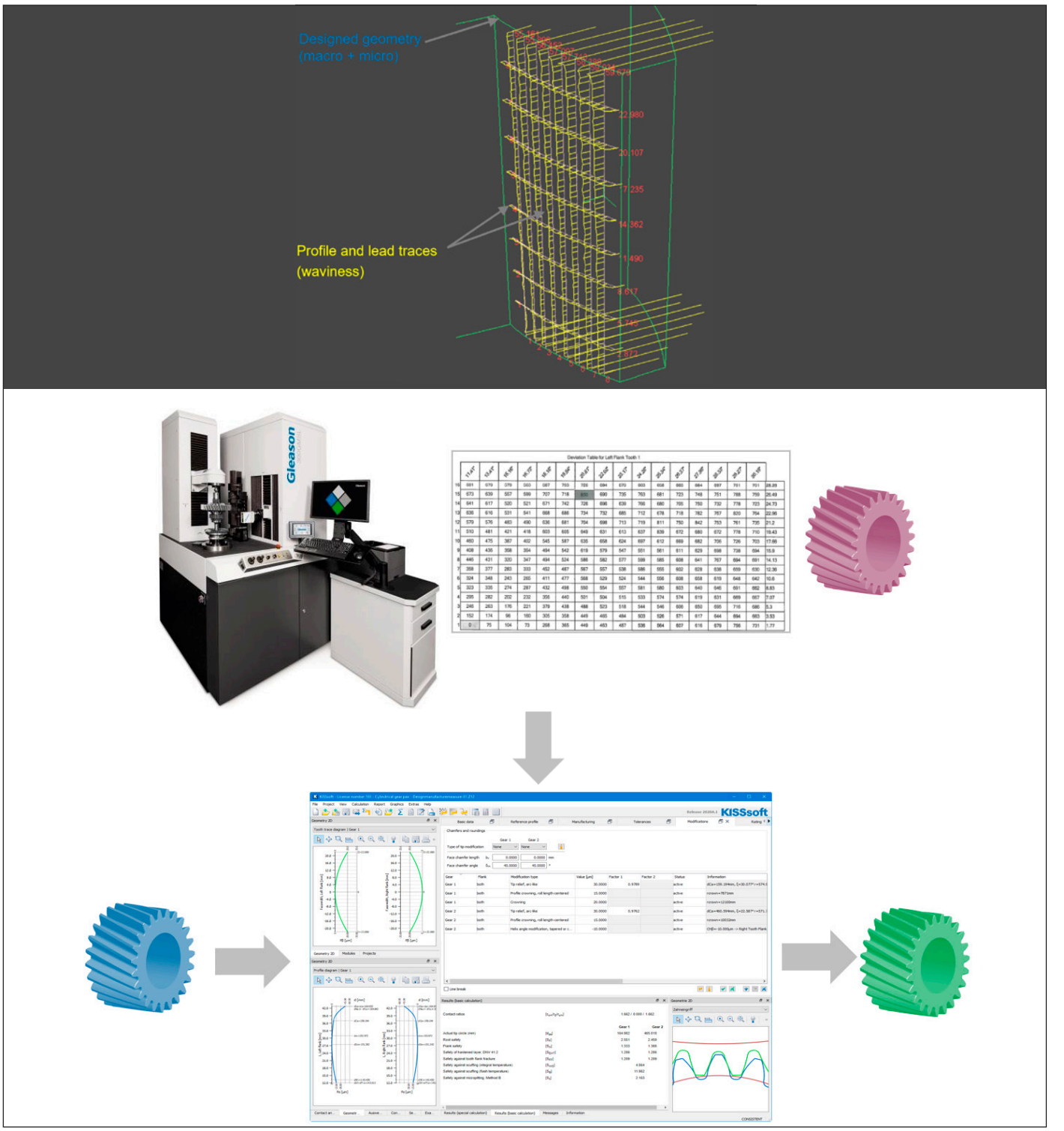

Figure 8—Left: Gear flank is measured along traces in profile and lead direction. Right: Traces, containing the information on the deviation from the designed geometry are transferred to* KISSsoft*. There, designed geometry is combined with the deviation along profile and lead traces to create the digital twin.

writing this paper, this was not yet automatically possible but required a manual approximation of the shape of the trace in the gear design software, using functions to approximate it there. Note the comment in the section on "Future Work" where this point is addressed as a subject for improvement of the software interface.

With this approach, the digital twin contains far more information on the manufactured gear since a much higher number of data points is considered. At the time of writing this paper, however, it is only possible to import one trace in lead and one trace in profile direction (or one trace with an inclination as explained in the following section). This is again a shortcoming of the current software version to be addressed in the future. The underlying assumption is that waviness is a systematic result of the manufacturing process, manufacturing machine and tool properties. Hence, it is reasonable to assume, in a first approximation, that the waviness in profile direction is constant along the face width or the waviness in lead direction is constant in profile direction. In the next section, definitions and descriptions of how the waviness is defined in the gear design software are given.

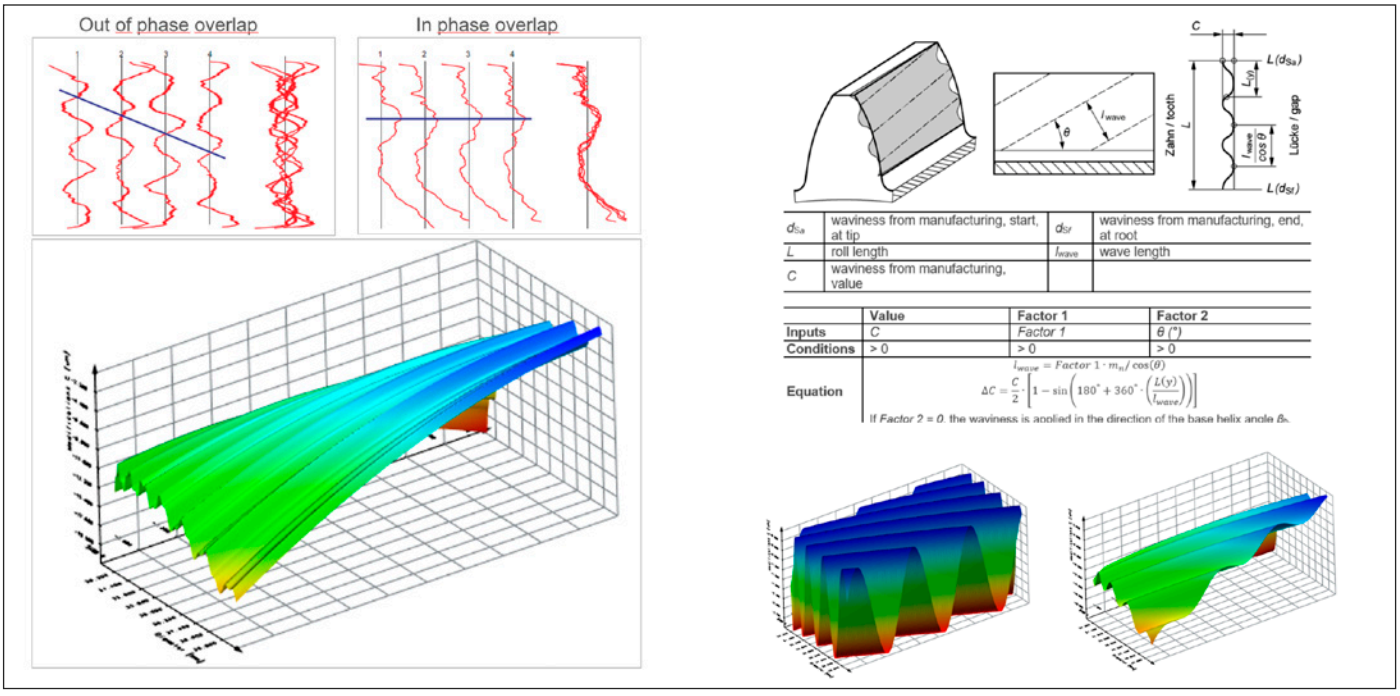

Figure 9—Top: Waviness along profile, as an overlap of several sinus forms. Bottom: Definition of one sinus form, inclined to the profile direction by an angle. Definitions as used in KISSsoft Gear Design Software.

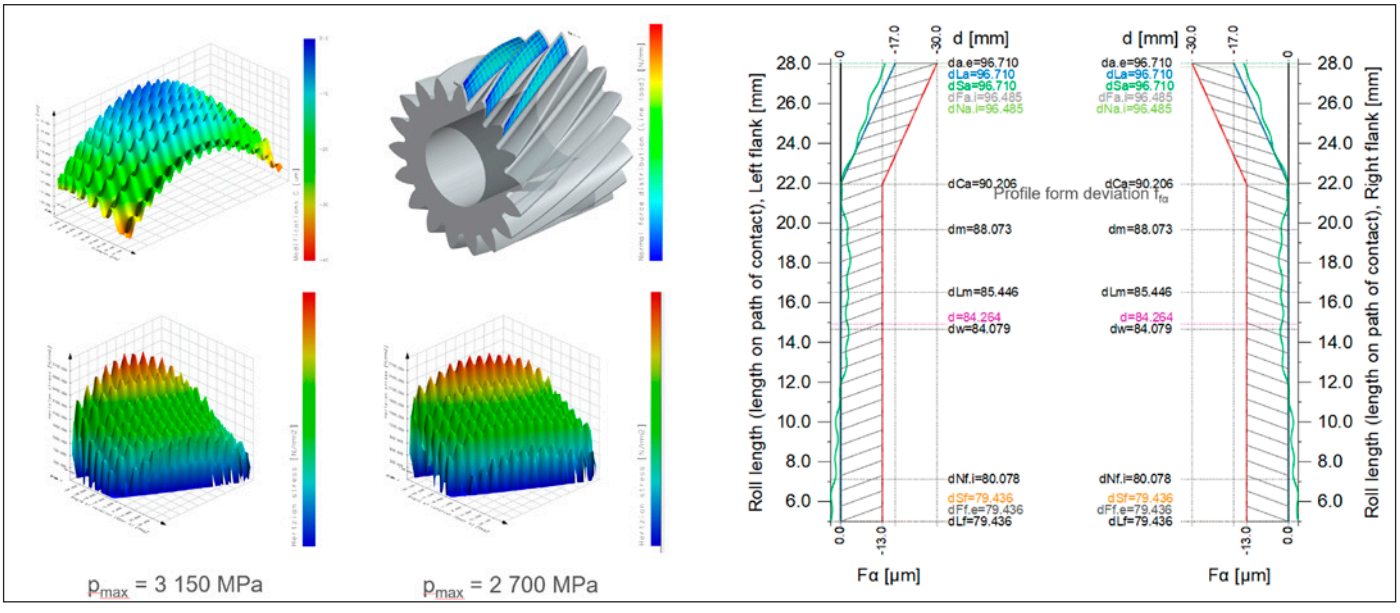

Figure 10—Left: Waviness in lead and profile direction, flank geometry and contact stresses. Right: K-chart or profile diagram showing the tolerance for a gear with tip relief and approximated flank geometry including waviness.

Definitions and Description of Waviness

On the left side of Figure 9, the waviness is shown as a three-dimensional image. The vertical axis shows the deviation of the manufactured and measured geometry from the designed geometry. Note the waviness in one direction. Note that the plane is twisted due to the natural twist from manufacturing. Note that this waviness is concerning one flank. In a mesh, several flanks are in contact at one point in time, and the waviness in one contact and the waviness in the next contact (for contact ratio above unity) overlap. On the right side of Figure 9, the definition of waviness on the flank, inclined by an angle, is shown. The amplitude, wavelength, inclination angle and phase shift are needed to define the waviness where the shape is a sinusoidal form. If the angle is set to zero, a waviness in profile direction results; if set to 180 degrees, a waviness in lead direction results.

Several such waviness definitions may be superimposed. On the left of Figure 10, waviness patterns in lead and profile direction are superimposed, creating a "rough" gear flank. Depending on the amplitude of this "roughness", different maximum peak stresses result. Such an approach may be helpful to explain the formation of micropitting in a pattern resembling grinding marks. In the right of Figure 10, several waviness definitions having different phase shift, amplitude and wavelength are superimposed in the profile direction. This results in a composite waviness in profile direction that is not intuitively recognized as a superposition of sinusoidal shapes but looks realistic.

To represent the measured waviness, e.g., in profile direction, the user must come up with several sinusoidal curves and superimpose them. By adjusting phase shift, amplitude and wavelength for each sinusoidal curve, different patterns for the resulting waviness are achieved. With this approach, by increasing the amplitude, wear of a tool and an increase in waviness in production between dressing of the tool may be considered. Currently, the software lacks the functionality to create the individual sinusoidal shapes, again, a function to be added.

Application

Gear Mesh Example

To illustrate the effect of waviness on calculated performance characteristics like transmission error and load distribution, we use a pinion gear mesh. Both gears are spur gears. As a reference calculation, only profile crowning is applied to the pinion. For a second calculation considering gear waviness, a waviness is applied on the pinion, having a reference amplitude. For a third calculation, the waviness amplitude is doubled. An LTCA for the three meshes is performed and the results are shown in Figure 12.

We observe that the line load changes very little, far less than what would be needed to indicate the need for a change in design. It is interesting to note that the PPTE value does not change proportionally to the waviness amount. The most interesting result is that for the gears having waviness, the higher-order amplitudes in the spectrum of the transmission error increase. Here, we see the influence of the waviness on the transmission error.

The above is not a systematic approach to the phenomenon of waviness and its influence on the performance of a gear mesh. Far more extensive parameter studies are required. However, it does illustrate that

- There is an influence of the waviness on performance characteristics.
- They are accessible through LTCA.

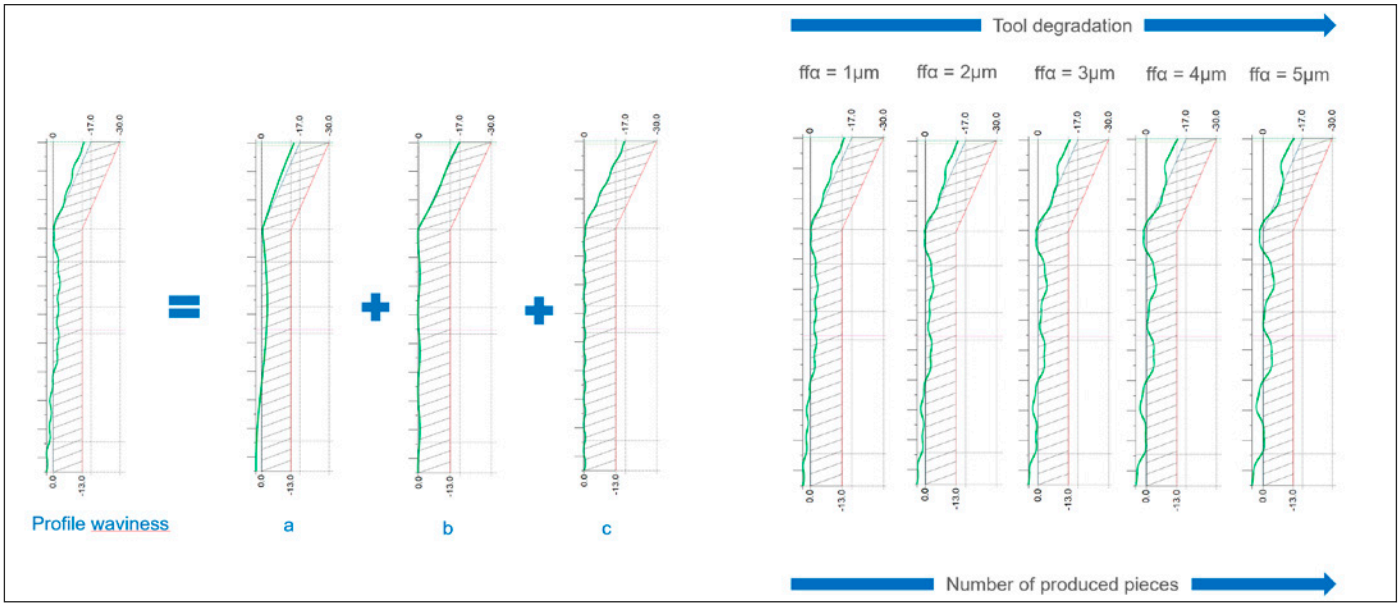

Figure 11—Left: Approximation of the measured waviness by superimposition of a few sinus-shaped forms with different amplitude, phase and wavelength. Right: Same form of waviness but increasing amplitude to study the effect of e.g., tool wear.

- Results are plausible and encouraging.
- The influence of waviness is negative (stresses and PPTE increase).

The increase in PPTE indicates that the excitation of a gearbox housing by the gear mesh will be more in case waviness is present. This aspect is investigated in detail in the next section.

Gearbox Example

In a final step, the response of the housing in a stage railway gearbox is studied. In a prior step in the project, the original gear macro- and microgeometry was optimized. A forced response analysis was conducted using the gear mesh force variation during the meshing cycle as excitation. The housing response was calculated for both the original and optimized gear macro and micro geometry and the gearbox equivalent radiated power as an indicator for airborne noise was compared. No waviness was applied to the gears.

Using the same methodology and tools, the gear mesh force variation was calculated using the optimized gear, once without waviness, once with waviness applied. For this, the LTCA as implemented in *KISSsoft* was used. For the gear without waviness, the gear mesh force variation was 2,110 N, whereas for the gear having waviness, it was 2,500 N (rounded to 10 N each).

The variation in gear mesh force, calculated in the forced response analysis in *KISSsoft*, resulted in variation of bearing forces as shown on the left side of Figure 15. The bearing forces (in the time domain) are exported from *KISSsoft* and imported into *RecurDyn*, where the

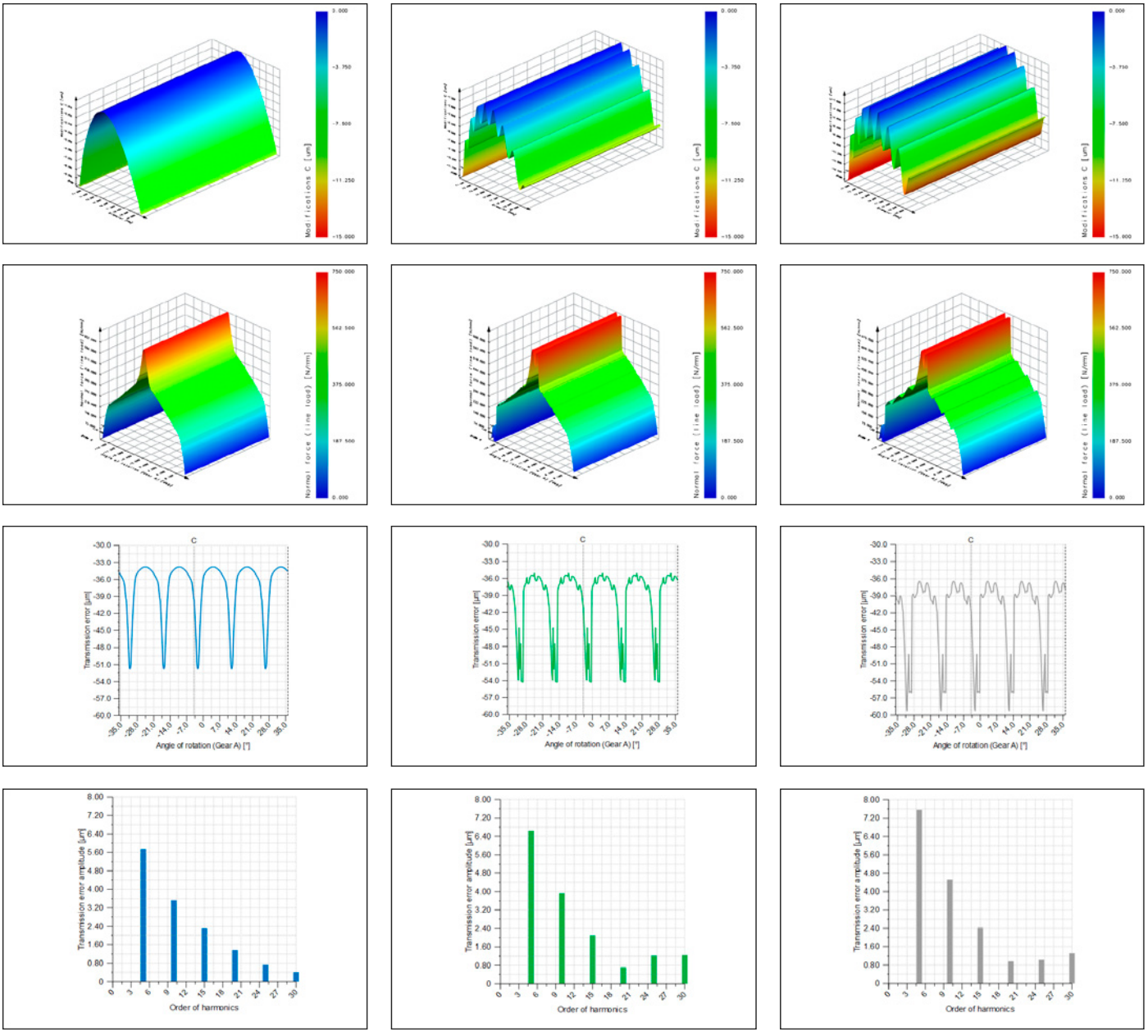

Figure 12—Left column: results without waviness. Middle column: results with waviness, amplitude = reference amplitude. Right column: results with waviness, amplitude = 2 x reference amplitude. First row: Profile modification, superimposition of profile crowning plus waviness. Second row: Contact force over mesh. Third row: Transmission error. Fourth row: Amplitude spectrum of transmission error.

	Waviness = 0 x reference value	Waviness = 1 x reference value	Waviness = 2 x reference value
Line load [N/mm]	735	743	749
PPTE [um]	18	19	23
TE, 1st comp. [um]	5.74	6.65	7.56
TE, 2nd comp. [um]	3.53	3.92	4.53
TE, 3rd comp. [um]	2.32	2.10	2.43
TE, 4th comp. [um]	1.38	0.70	0.97
TE, 5th comp. [um]	0.74	1.22	1.03
TE, 6th comp. [um]	0.40	1.24	1.33

Table 1—Numerical values for line load, PPTE and transmission error amplitude spectrum.

	Waviness = 0 x reference value	Waviness = 1 x reference value	Waviness = 2 x reference value
Line load [N/mm]	1.00	1.01	1.02
PPTE [um]	1.00	1.06	1.28
TE, 1st comp. [um]	1.00	1.16	1.32
TE, 2nd comp. [um]	1.00	1.11	1.28
TE, 3rd comp. [um]	1.00	0.91	1.05
TE, 4th comp. [um]	1.00	0.51	0.70
TE, 5th comp. [um]	1.00	1.65	1.39
TE, 6th comp. [um]	1.00	3.10	3.33

Table 2—Normalized values for line load, PPTE and transmission error amplitude spectrum.

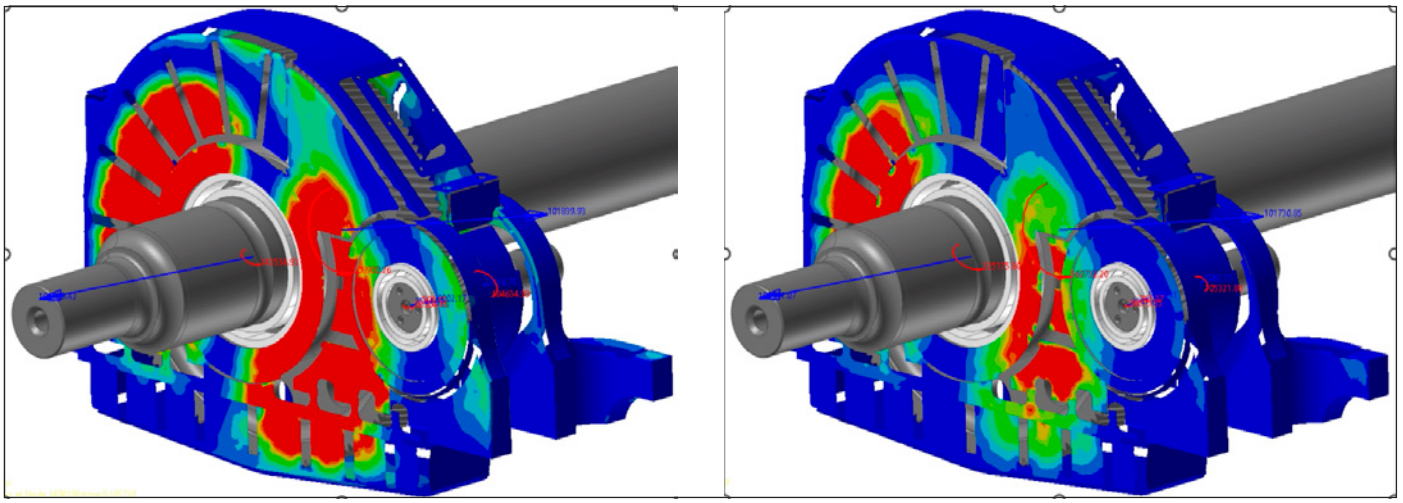

Figure 13—Left: Housing equivalent radiated power for reference gear macro and micro geometry. Right: Housing equivalent radiated power for optimized gear macro and micro geometry. In both cases, no waviness.

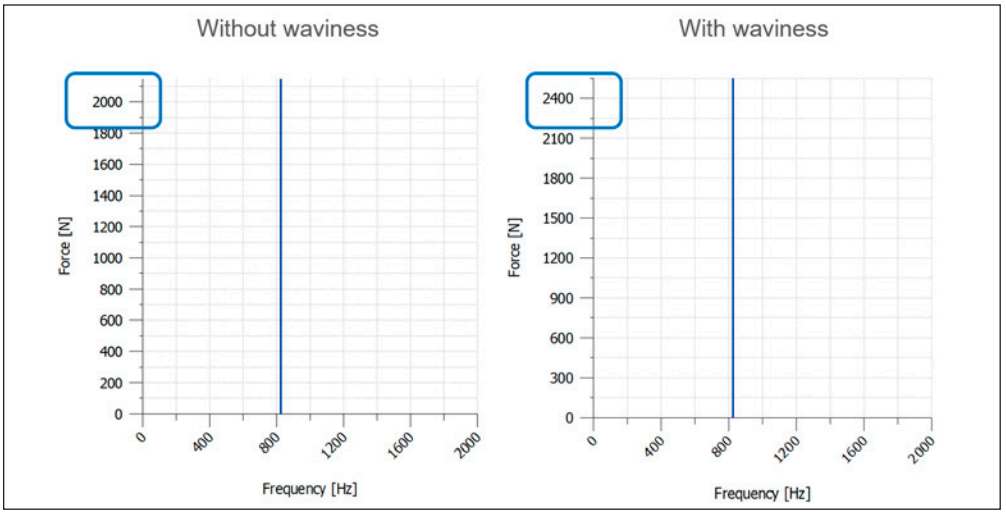

Figure 14—Left: Gear mesh force, maximum over a pitch, computed through LTCA, for a gear having no waviness defined. Right: For the same gear but having waviness.

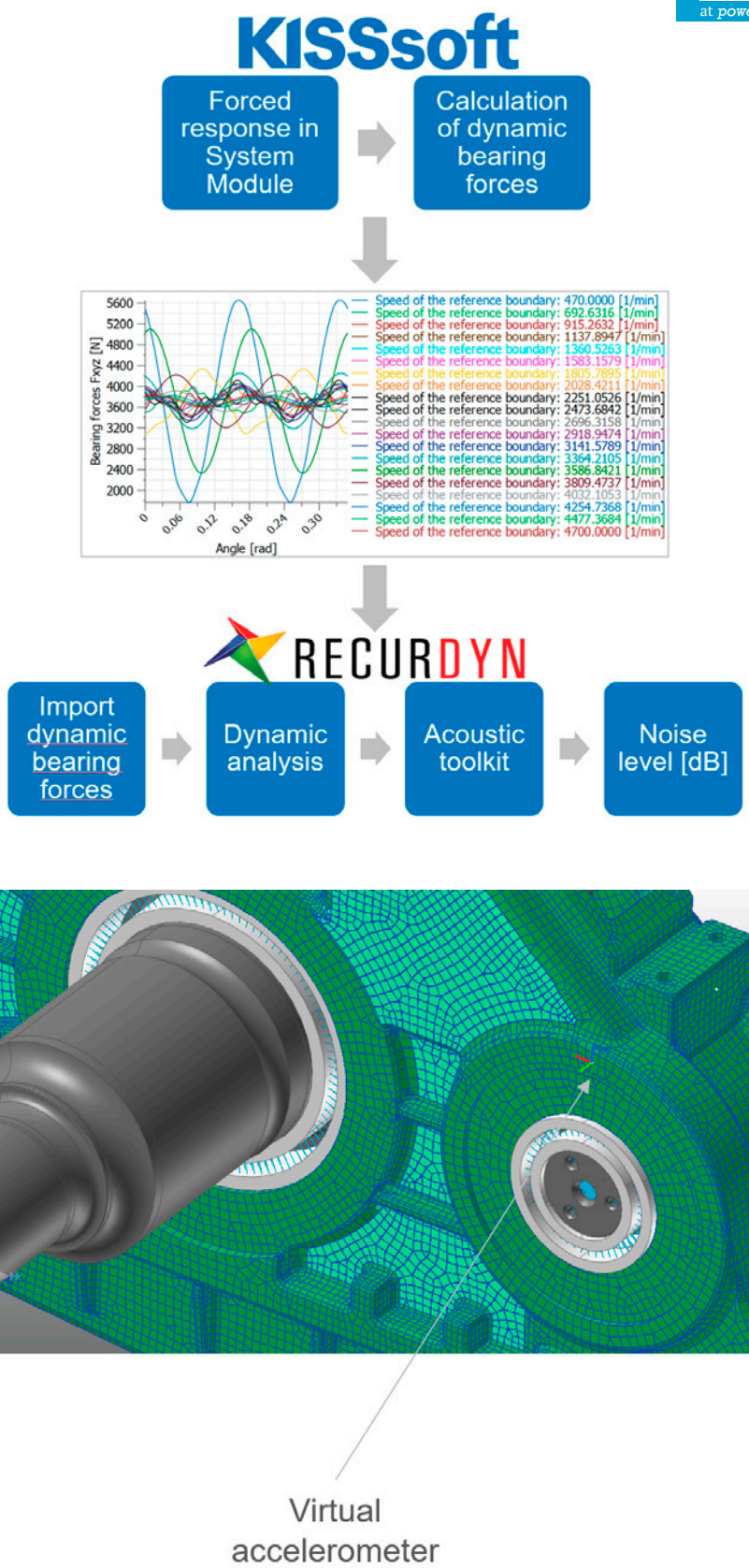

Figure 15—Left: using* KISSsoft *to calculate bearing forces in the time domain, RecurDyn to calculate housing excitation therefrom. Right: Virtual accelerometer placed on housing to measure displacement, velocity and acceleration.

housing is subjected to dynamic analysis. On the housing, several virtual accelerometers are placed at critical locations and displacement, velocity and acceleration in the nodes where these virtual accelerometers are placed are recorded in the time domain.

Converting the time domain results by Fourier transformation into a frequency domain result allows for plotting of the e.g., velocity vs. frequency. On the left side of Figure 16, the velocity of the node where the virtual accelerometer is placed is shown for the gear without waviness applied. We see a few peaks at low frequencies and then a peak at the gear mesh frequency of 825Hz. We see the same peak, but at a higher amplitude, for the gear with waviness applied on the right side of Figure 16. The velocity increases from 3.58 m/s to 4.75 m/s, an increase of 33 percent.

With this, we may conclude that the process, methods and tools are likely to be suitable for the assessment and optimization of waviness aiming at a reduced gearbox noise level. Obviously, further work to deepen the understanding of the approach and results is needed. Also, this approach is not automatized and requires experience and engineering judgement for the assessment of results. It is currently suitable for specific projects or troubleshooting, but not for use in quality control of thousands of gears. In sound critical applications where a few units of gears are used, e.g., marine gearboxes, the above process looks promising. It also looks promising for critical applications where many units with consistent manufacturing are manufactured, e.g., for aerospace or EV gearboxes.

Further Works

Parametric and Other Studies

These aim at two areas: improvements in the model and tools used. Model improvements include:

- Increase the resolution in the digital twin.
- Automatic approximation of each trace as measured by superimposition of sinus forms.
- Automatic data transfer between *KISSsoft* and *GAMA*.
- Extend calculation to ERP (equivalent radiated power) as a measure for sound emission from housing as shown on the right, where two macrogeometries are compared (without influence of waviness).

Secondly, in application experience and validation:

- Project collaboration with industrial partners or research institutes.
- Adapt methods to different types of products.
- Extend methodology to bevel gears.

Currently, the authors work on studies to calculate the housing vibration and equivalent radiated power ERP as an indicator for the noise perceived, using parallel shaft gearboxes. In previous works, the influence of optimized gear macro- and microgeometry on the housing vibration has been shown. The calculation process is now adapted and refined, such that the influence of waviness on the housing excitation may be studied.

Patent

The patent WO2023208958A1, filed by KISSsoft AG—A Gleason Company, introduces a method to predict and reduce noise in gear pairs, crucial for improving noise and vibration characteristics in transmissions, especially for electric vehicles. The method focuses on measuring and analyzing deviations in gear tooth flanks by applying the Fourier transformation to pinpoint

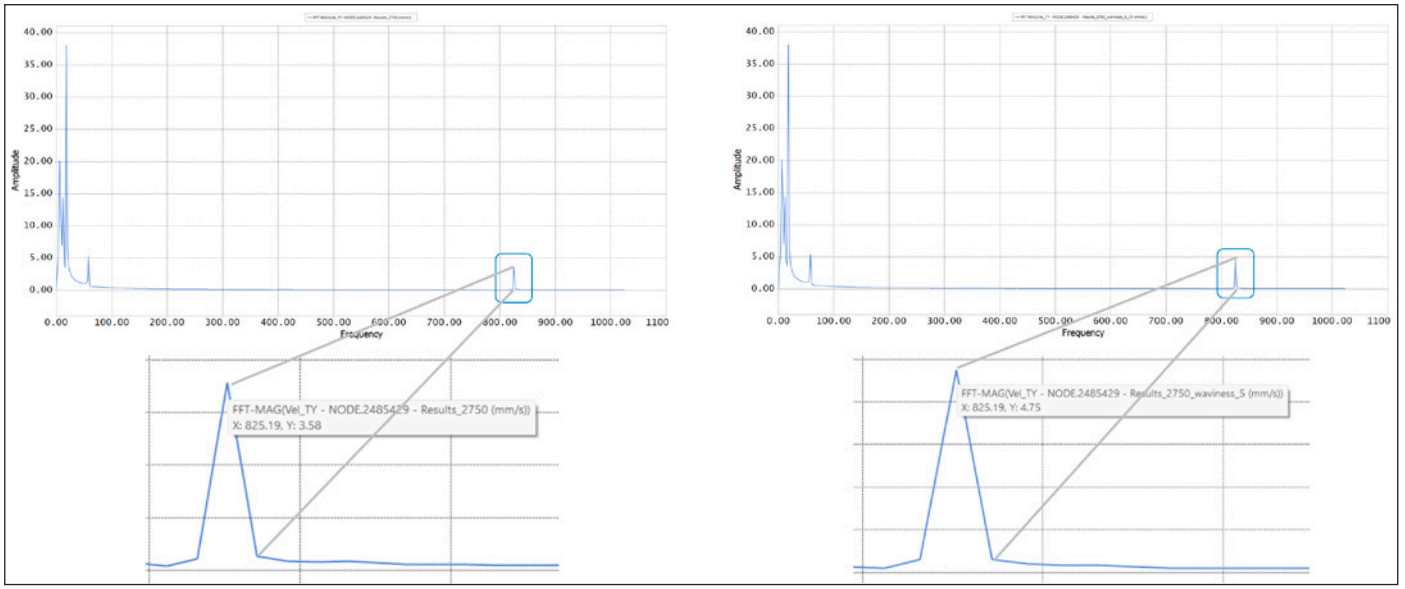

Figure 16—Left: Housing velocity at the position of virtual accelerometer, for housing frequency = gear mesh frequency, for gear not having waviness. Right: For gear having waviness.

specific vibration frequencies that contribute to noise. By isolating these critical frequencies, the approach allows for targeted design adjustments, reducing undesirable noise more effectively. The invention also offers flexible analysis, usable with standard testing equipment and adaptable software solutions for practical gear production settings.

This patent describes a novel method for predicting noise emissions in gear pairs, specifically focusing on noise reduction for transmissions, such as those in electric vehicles. When two gears engage, vibrations and noise often arise due to deviations in the tooth flank surfaces, even if the gears meet high-quality standards. These noise issues, termed NVH (Noise, Vibration, and Harshness), are challenging to resolve as they are influenced by multiple factors, including gear accuracy, manufacturing variances, and operational load conditions.

Traditional approaches to predicting gear noise often rely on examining overall deviations between the manufactured tooth flank and an idealized target profile. However, these methods can fail to capture the specific deviations that directly contribute to noise emissions. This invention improves current methods by isolating only specific parts of the surface deviation that have the most significant impact on noise. By transforming these deviations into a "complementary space" (usually through Fourier analysis), the method highlights critical frequency components, making it easier to target problematic vibrations. The Fourier analysis breaks down the tooth surface deviation data into individual frequency components, identifying both "mesh" frequencies (frequencies expected due to gear motion) and "ghost" frequencies (unexpected frequencies with no direct relation to gear movement or geometry). Analyzing these specific frequencies allows for precise adjustments to be made in the design and manufacturing stages, significantly reducing gear noise.

This invention also enables customization based on feedback from real-world noise measurements, such as those conducted in end-of-line tests by manufacturers. For instance, if a specific interference frequency is identified during testing, this method allows engineers to trace back and identify which deviations are likely to cause it. This adaptive capability ensures that noise prediction is not just theoretical but grounded in actual measurements, enhancing reliability and relevance for real transmission systems.

The proposed method can be implemented using standard gear testing machines equipped with contact or non-contact sensors to gather measurement data. The analysis process can be further integrated with software (such as *KISSsoft*), which handles the load-related contact analysis. As an alternative, some analysis steps can be conducted directly on the testing machine, offering flexibility in how the data is processed. Additionally, this method can be adapted into software or testing devices, providing a range of tools for gear noise analysis and optimization.

Overall, this approach represents a significant advancement in gear design, enabling manufacturers to develop quieter gear systems through detailed analysis and targeted frequency-based interventions. By focusing on specific noise-causing deviations rather than broad surface differences, it allows for a more focused reduction in noise emissions, resulting in longer-lasting, higher-performance gear systems with minimal NVH.

Summary

The paper presents a patented process aimed at representing a manufactured gear as a digital twin. This innovative approach allows for the accessibility of the manufactured gear in calculations, facilitating comparisons with the designed gear.

As a result, the assessment of the manufactured gear can encompass not only geometrical properties, such as the gear quality number, but also performance characteristics, including transmission error and housing excitation. The resolution of the digital twin has been expanded to include not only the macro- and microgeometry of the gear but also flank waviness.

Research has demonstrated that considering flank waviness in the digital twin significantly influences housing vibration. However, further work is necessary to enhance the fidelity of the digital twin by increasing the resolution of the model.

PTE

Hanspeter Dinner, managing director at KISSsoft AG, studied mechanical engineering at ETH Zurich. His background includes FEM work on vehicle bodies, medical devices, and structures for satellites and roller coasters. With over 20 years at KISSsoft, he focuses on gear software applications, planetary gearbox design, tooth contact analysis, and testing.

Calogero Principato, senior engineer, technical sales at KISSsoft, was born in Italy in 1986 and holds a Mechanical Engineering degree from the University of Modena and Reggio Emilia, the "Enzo Ferrari" Department of Engineering. With 10+ years in aviation and automotive gear design, he joined KISSsoft in 2023 and supports AGMA's electrified vehicle design initiatives.

EATON CUMMINS AUTOMATED TRANSMISSION TECHNOLOGIES

Celebrates 500,000th Endurant Transmission Milestone with Werner

Eaton Cummins Automated Transmission Technologies has announced the production of its 500,000th Endurant transmission, a significant milestone that underscores Eaton Cummins' ongoing commitment to delivering innovative, efficient, and high-performance powertrain solutions for the commercial vehicle industry.

The 500,000th unit was delivered to Werner, a long-standing customer and one of the first fleets to adopt the Endurant transmission following its debut in 2017. Werner's continued investment in the Endurant platform highlights the transmission's proven performance, durability, and fuel efficiency across diverse applications.

To commemorate the achievement, a special ceremony was held at the Kenworth Truck Plant in Chillicothe, Ohio, where a new Kenworth T680 equipped with the milestone transmission rolled off the assembly line. Eaton Cummins presented a commemorative plaque to Werner in recognition of their partnership and shared dedication to innovation.

"We are incredibly proud to reach this milestone and to celebrate it with Werner, a fleet that has been with us since the beginning of the Endurant journey," said Josh Mejeur, regional director, Eaton Cummins. "This achievement reflects the strength of our partnerships and the value our customers see in the Endurant platform."

"Werner has worked with Eaton for more than 40 years, and we were proud to receive the very first Endurant transmission," said Scott Reed, Werner's senior vice president of maintenance. "This milestone reflects our shared commitment to innovation and providing our drivers with reliable, efficient equipment that delivers for our customers."

The Endurant transmission family has grown to include multiple variants, including the Endurant HD, Endurant HD V, Endurant HD N, Endurant XD, Endurant XD Pro and Endurant XD N, serving both on-highway and vocational markets. Known for its lightweight design, advanced software features, and driver-friendly operation, the Endurant continues to set the standard for automated manual transmissions in North America and beyond.

eatoncummins.com

REGAL REXNORD

Expands High-Performance Coupling Recertification Service

Regal Rexnord Corporation has expanded its high-performance coupling recertification service. The enhanced service provides critical support for maintenance and operations professionals in the oil and gas sectors and other turbomachinery users.

In the demanding oil and gas environment, where turbomachinery is considered critical equipment and unplanned downtime can be costly, the reliability of every component is paramount. Couplings are crucial components, and improper maintenance can lead to unscheduled downtime and even damage to connected equipment. Regal Rexnord's expanded recertification service directly addresses these challenges by offering a robust, cost-effective and sustainable alternative to coupling replacement.

A key part of the recertification offering is the commitment to more localized service and expedited turnaround times. Regal Rexnord maintains repair facilities in strategic global locations, including Florence, Kentucky, United States; Nove Mesto, Slovakia; Hyderabad, India; Sao Paulo, Brazil, Zhangzhou, China, and Sydney, Australia.

This global footprint ensures that customers can access recertification services closer to their operations, significantly reducing shipping times and accelerating the return of critical components to service. While new couplings can have lead times from 16 weeks or more, recertification can be completed in a much shorter timeframe that works around the needs of end users. This accelerated process enables maintenance and operations teams to improve maintenance schedules and maximize asset utilization.

"At Regal Rexnord, we understand the pressures faced by our customers in the oil and gas industry to maintain continuous operations and optimize their assets," said Greg Mackie, global product manager. "Our expanded coupling recertification service underscores our dedication to providing solutions that not only extend the life of valuable equipment but also deliver

tangible benefits in terms of uptime, efficiency and cost savings."

The high-performance coupling recertification service offers a meticulous inspection, refurbishment and retesting process for a wide range of industrial couplings, including those from Kop-Flex, Ameridrives, Bibby Turboflex, Rexnord and Euroflex. This comprehensive process includes:

- Disassembly and complete mechanical and metallurgical evaluation.
- Replacement of all hardware, including disc packs, bolts, nuts, washers and shims.
- Glass bead blasting to remove rust or stains.
- Rebalancing for optimum performance.
- The ability to incorporate updates or modifications to the coupling design.

Each recertified coupling meets stringent quality standards, ensuring performance that is equivalent to new but at a cost that can be half that of a new coupling.

regalrexnord.com

IVAN TORRES

Appointed President of Avers Machine and Gear

Avers Inc. recently announced the promotion of Ivan Torres to the position of president of Avers Machine and Gear. This leadership transition marks a new chapter in Avers Inc.'s continued commitment to operational excellence and sustained growth within the industry.

Torres, a dedicated industry professional, brings over 26 years of experience to his new role. Having joined Avers Inc. in 2015, he has played a key role in the company's growth, leading initiatives in sales and marketing, customer development, planning, and front-end operations. During his time at Avers, the company has expanded its facilities from 12,000 to over 35,000 square feet, quadrupled sales, and acquired Fox Tool & Manufacturing and Innovative Rack & Gear. As part of the finance team, Torres focuses on reinvesting in the company to promote growth, enter new industries, and continually improve quality while maximizing cost efficiencies.

Ivan Torres

Torres combines forward-thinking strategies with respect for the company's core values, drawing on his deep understanding of the business gained through years of experience transitioning from back-end operations to leading the front end.

"Being part of Avers Inc. has been nothing short of an honor," said Torres. "I take great pride in the company and the remarkable growth achieved through the dedication of our team. My vision is to continue shaping Avers Inc. into a company defined by integrity, profitability, and innovation, while staying true to its core values. Torres emphasizes the importance of leading by example, working hard, and maintaining consistency. He is deeply committed to fostering workforce development and strengthening the company's foundation for future success.

aversinc.com

MOTION

Announces Joint Venture with Canadian Indigenous Development Firm

Motion-Canada: (Left to right) Rob Mulyk, Division VP for British Columbia, Motion; Jerry Asp, President of Tagodi Corp. and Tahltan Elder; Greg Peters, Division Business Development Manager, Motion.

Motion Industries, Inc. is pleased to announce a joint venture partnership with Tagodi Development Corporation. This resource contracting firm invests in the local Tahltan Nation in northern British Columbia, Canada.

An agreement was recently signed with the objective of delivering economic and operational benefits to the community and all involved. The largest focus will be on the mining sector, a major portion of this region's industrial landscape.

Specifically, the partnership will:

- Support mutual goals for Truth & Reconciliation, including economic prosperity.
- Help build sustainable communities and create economic opportunities, including employment and skill development for the Tahltan People.
- Foster collaboration with local experts to support mining operation growth in northern British Columbia.

Jerry Asp, president of Tagodi Development Corporation and Tahltan Elder, said:

"My family is very pleased to have entered into a joint venture with Motion. I believe we will be able to deliver a new level of service to the Tahltan Nation and the mining industry in Tahltan Traditional Territory."

Brent Pope, Motion's senior group vice president, Canada and sales excellence, added:

"Working with Tagodi, we aim to drive positive economic impact in the mining sector while supporting local development initiatives and honoring the region's unique cultural heritage. We look forward to deepening our community connection."

Motion is dedicated to working alongside Indigenous peoples and their communities in BC and beyond, cultivating enduring, trust-based partnerships.

motion.com

B&R
Welcomes FPE Automation as Value Provider

Shaun Kneller, director of global accounts and end user sales US at B&R, presents the official B&R Technical Distributor plaque to the FPE Automation team.

B&R, the Machine Automation Division of ABB, recently announced a new distribution partnership with FPE Automation to expand its local service and support capabilities in Illinois, Iowa, and Missouri. The collaboration, part of B&R's Value Provider Program (VPP), is designed to bring advanced automation technologies and comprehensive support closer to regional machine builders and manufacturers, reinforcing B&R's commitment to delivering cutting-edge solutions through a trusted network of partners.

FPE Automation is now offering B&R's full portfolio including control, motion, robotics, mechatronics, safety, and visualization. Customers benefit from a single point of contact for their entire automation solution. This unified approach simplifies project execution and enhances system integration, helping customers reduce complexity and accelerate time to market.

With FPE Automation as a trusted regional partner, customers in Illinois, Iowa, and Missouri will benefit from faster, more responsive local support. They will gain access to B&R's cutting-edge technologies, including adaptive machines and integrated robotics. The partnership enables streamlined engineering through a unified software platform, allowing for closer collaboration with application experts who can deliver tailored solutions. These advantages contribute to improved efficiency and performance across automation systems.

"For over 60 years, FPE Automation has built a reputation for delivering best-in-class automation solutions," said Adrian Lovatt, partner manager at B&R Industrial Automation North America. "Their strong market presence and technical expertise make them an ideal partner to bring B&R's innovations to more customers in the Midwest."

"B&R's broad portfolio, coupled with the most innovative solutions centered around a unified software platform, helps FPE Automation better serve the needs of our valued clients," added Jomy Vadakumpadam, vice president, sales and engineering at FPE Automation.

FPE Automation's team is fully equipped to support B&R's technology and provide expert guidance throughout the automation lifecycle. This partnership reflects B&R's ongoing commitment to delivering high-performance, scalable solutions with local support that meet the evolving needs of machine builders and manufacturers.

br-automation.com

GKN AEROSPACE
Extends Partnership with Pratt & Whitney

GKN Aerospace is pleased to announce the signing of a five-year contract extension with Pratt & Whitney, a RTX business, to continue providing engine component repair services through 2029. This renewal further strengthens the longstanding collaboration between the two companies and underlines GKN Aerospace's position as a trusted provider of critical engine component repair services.

Under the extended contract, GKN Aerospace will continue to deliver high-quality repairs on Pratt & Whitney and IAE V2500 engine fan blades out of the San Diego site. The services support Pratt & Whitney affiliate locations worldwide and contribute to maintaining performance, reliability, and supply chain continuity.

"This extended agreement is a strong vote of confidence in the value, reliability, and global capability of GKN Aerospace's Repair Solutions," said Gerald Coste, senior vice president for GKN's Engines MRO Business. "We're proud to continue supporting Pratt & Whitney and its affiliates around the world with industry-leading MRO services."

The extension reflects the shared commitment of both companies to advancing operational excellence, supporting global fleets, and driving efficiency in aftermarket services.

gknaerospace.com

September 27–October 1

Weftec 2025

More than 20,000 water professionals come to Weftec each year to share ideas, spark innovation and move the industry forward. At Weftec 2025 (Chicago), you'll find exhibits, hands-on learning experiences and a global network of water professionals. The show features 1,000+ exhibitors showcasing the latest water and wastewater technologies, solutions and services. More than 130 technical sessions examine topics such as energy management, maintenance, operations, treatment technologies, global insights, research and development and more.

powertransmission.com/events/weftec-2025

October 21–23

Motion + Power Technology Expo 2025

Produced by AGMA, Motion + Power Technology Expo (Detroit) is a three-day show that connects professionals looking for motion power solutions with manufacturers, suppliers and buyers. Attendees will find new power transmission parts, materials and manufacturing processes. End-users can shop the latest technology, gear products and services from leading manufacturers. Hundreds of exhibitors and attendees means MPT Expo is a unique opportunity to find partners that can help fulfill your specific production needs.

powertransmission.com/events/motion-power-technology-expo-2025

October 21–23

Southtec 2025

Southtec 2025 (Greenville, SC) draws manufacturing suppliers, distributors, and equipment builders from across North America and around the world. With hundreds of exhibiting companies, attendees can find all the latest technologies and services—plus the experts who build them—ready to demonstrate solutions that can help them grow their business. Visitors can make side-by-side comparisons, discover integrated equipment, hear about industry trends and forecasts and leverage their purchasing power. Explore more than 300 exhibits featuring areas such as automation, robotics, smart manufacturing, precision machining, software solutions, and industrial IoT.

powertransmission.com/events/southtec-2025

October 29–30

Advanced Engineering UK 2025

Advanced EngineeOring (Birmingham, UK) showcases how manufacturing products and solutions meet capability challenges, enhance manufacturing processes and help companies stay at the forefront of industry trends. In 2025, buyers and procurement teams, decision-makers, R&D and directors from leading OEMs, Tier 1 & Tier 2 companies will be eager to engage with the latest technologies and manufacturing solutions. The show also raises awareness and fosters collaboration among businesses, educational institutions, associations and the government to develop a skilled workforce capable of driving the UK's manufacturing and engineering sector.

powertransmission.com/events/advanced-engineering

November 25–30

Smart Production Solutions (SPS) Nuremberg

With its unique concept, the SPS 2025 (Nuremberg, Germany) covers the entire spectrum of smart and digital automation – from simple sensors to intelligent solutions, from what is feasible today to the vision of a fully digitalized industrial world. SPS is the highlight event of the automation industry. It is a source of inspiration and a platform for innovation. Topics include control technology, drive systems, components, software, sensors, industrial communication and more. One of the key topics at this year's SPS is the use of artificial intelligence in manufacturing technology. Industrial AI is currently making its way into a wide range of industrial products and processes: supporting process engineering, integrated into control devices via diverse AI models, or as part of intelligent tools for predictive maintenance, quality assurance, and adaptive production control. These technologies are fundamentally transforming automation and unlocking new potential for efficiency, flexibility, and resource conservation.

powertransmission.com/events/smart-production-solutions-sps-nuremberg

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Harnessing Noether's Theorem for Gear Optimization

Aaron Fagan, Senior Editor

Emmy Noether, whose 1918 theorem revealed the deep link between symmetry and conservation laws in physics.

In gear design, efficiency often comes down to a battle with vibration. High-speed gears in transmissions, turbines, and robotics inevitably bleed energy through friction, heat, and unwanted oscillations. These losses may look like background noise, but they add up to reduced performance, accelerated wear, and shortened service life. What if the key to reducing those losses came from a century-old breakthrough in theoretical physics?

In 1918, mathematician Emmy Noether proved a deceptively simple principle: whenever a system has a symmetry, something is conserved. Time symmetry means energy is conserved. Rotational symmetry means angular momentum is conserved. Physicists regard this theorem as foundational to everything from particle physics to relativity, but its relevance doesn't end there. For gear engineers, it offers a surprisingly practical lens for thinking about energy conservation and vibration control.

In an ideal gear system, energy would slosh cleanly back and forth between kinetic rotation and elastic tooth deflection, without any net loss. But in the real world, gears are never perfectly symmetrical. Materials flex, lubricants shear, surfaces rub, and losses creep in. Each small asymmetry breaks the neat conservation that Noether described. The result is energy leaking away in the form of noise, heat, or premature wear.

The real power of Noether's perspective is in its diagnostic potential. If energy is to be conserved in a perfectly symmetric, time-invariant system, then any observed energy loss becomes a signal. It tells the designer exactly where the symmetry has been broken, in tooth geometry, material properties, lubrication, or resonance behavior. In other words, vibration is not just a nuisance; it's a map of where efficiency is being stolen.

Modern simulation tools make this practical. Finite element analysis (FEA) doesn't just show stresses and deflections; it tracks how energy moves through a system. By plotting kinetic and potential energy over time, engineers can see how quickly energy decays and pinpoint where losses are doing the most damage. If the plot reveals energy vanishing too quickly, it's a clue to stiffen a tooth, adjust the geometry, refine lubrication, or switch to a material with better characteristics.

Take a spur gear subjected to sinusoidal loading, simulations will often show energy declining steadily as vibrations die out. By adjusting tooth stiffness or geometry, that rate of decay can be slowed, meaning less energy wasted. The gear runs smoother, quieter, and with lower wear. What began as an abstract theorem about symmetry becomes a very concrete design tool for optimization.

Aerospace gears running at extreme speeds can be tuned to avoid resonant frequencies that would otherwise bleed efficiency. Automotive transmissions can be made quieter by treating vibration as a conservation problem, not just a noise-control issue. Robotics can benefit from lighter, more efficient gearing where every bit of conserved energy extends battery life.

Noether's theorem reminds us that every vibration carries information. In the perfect symmetry of mathematics, energy is eternal. In the imperfection of steel and lubrication, it is not. By treating the loss of symmetry as a diagnostic, gear engineers gain a sharper way to understand and minimize waste.

It's a striking example of how theory and practice can collide in unexpected ways. A century-old insight from mathematical physics is now a fresh tool in the engineer's kit, turning abstract symmetry into quieter, longer-lasting, and more efficient gears.

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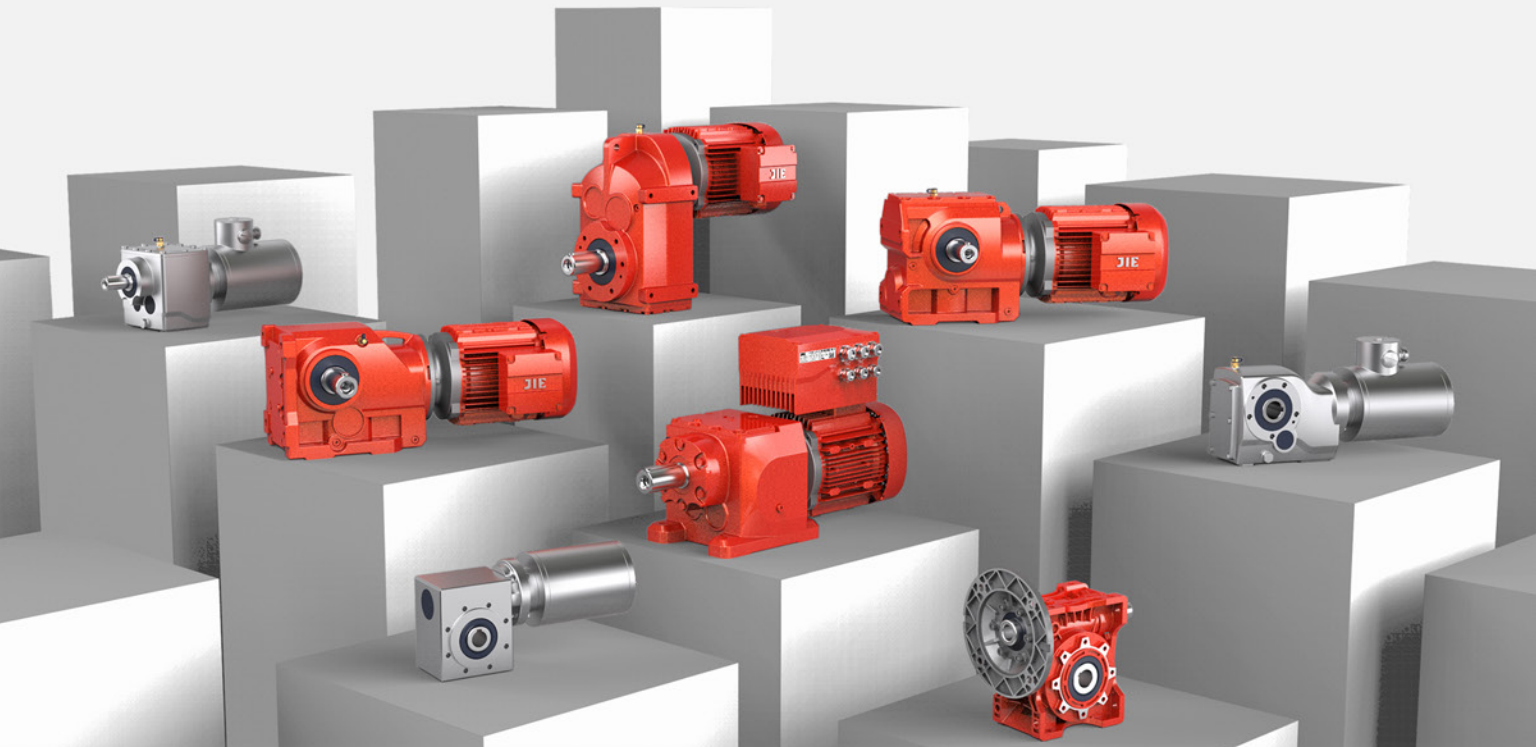

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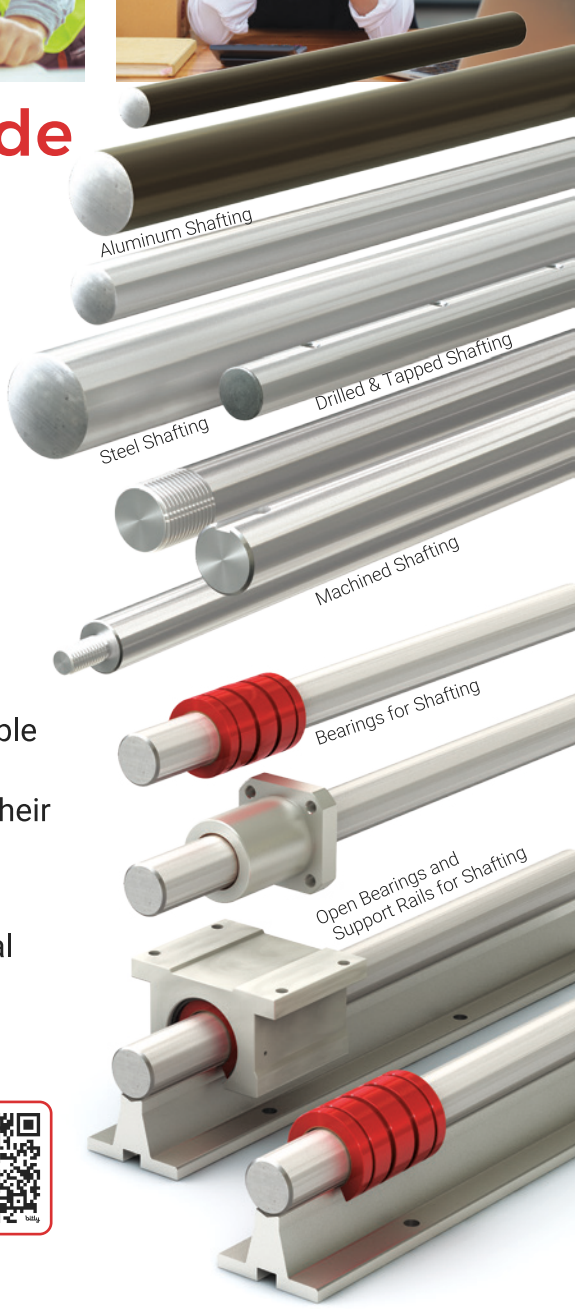

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