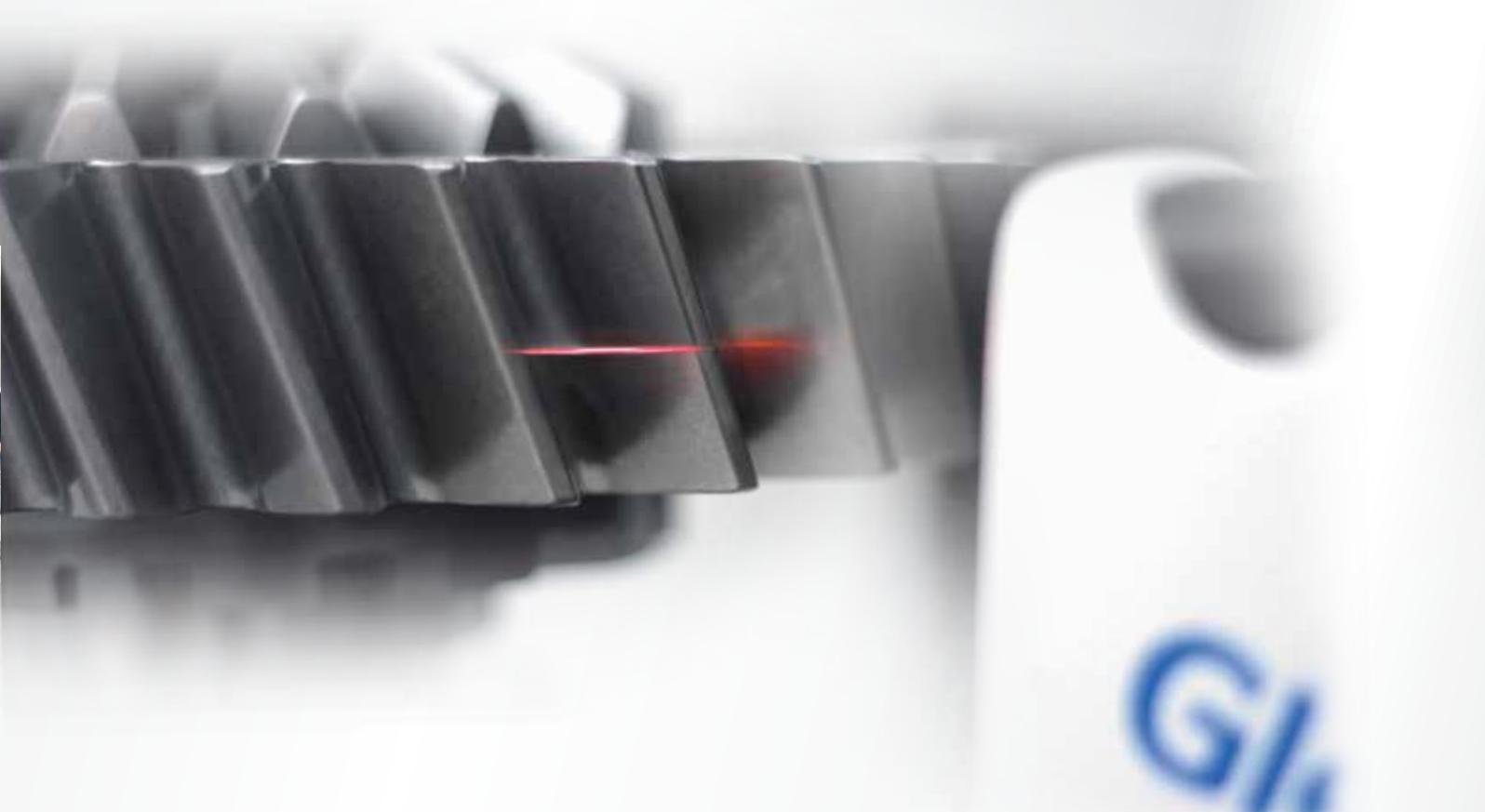


solutions

gear manufacturing technology magazine



Bright Spots In Gear Manufacturing

New GMSL Series
Introduces Laser
Technology to Gear
Metrology

New Solutions

Today's most exciting new gear production and inspection technologies.

Customer Success

SEW Eurodrive produces the gears that drive the world.

Special Reports

Advances in Power Skiving, hard gear finishing and chamfering/deburring technology.

Welcome to Gleason



John J. Perrotti

President and
Chief Executive Officer

Dear Valued Customers:

The emergence of new technologies is accelerating. Every aspect of our lives is impacted, from the device on your wrist tracking your heart rate, to the GPS in your car that keeps you on course. The same is true in global manufacturing. Tasks that have always been done manually are now routinely automated. Designs that were validated through trial and error now can be easily perfected with simulation tools. Machines in need of maintenance now tell us in advance through Industry 4.0 and the Internet of Things. And much more...

Gleason, the world's largest and most diverse source of machines and tooling for the production of gears, is as much a technology company today as machine builder. Our portfolio of technology solutions is evidence that we're working hard to find and apply new ways to solve gear design and production challenges for our customers. Case in point: our new 300GMSL Inspection System, which uses laser scanning to acquire data many times faster than conventional tactile measurement. It's an exceptional solution for quickly collecting vast amounts of data with sophisticated analysis tools to unlock new information about gear attributes. Here are some other recent examples:

Beginning with design, Gleason has introduced its new GEMS software which provides an advanced platform with the most powerful tools for the design, analysis, simulation and manufacturing of all types of bevel gears. This suite of software provides a simple touch screen user interface with well-proven calculation engines and finite element analysis tools. In February 2017, Gleason acquired KISSsoft AG, a leader in design, analysis and simulation tools for all types of gears and power transmission systems. These added capabilities will complement our GEMS solutions and we are excited about the new products ranging from design to production to inspection that will result.

Gleason 4.0 is how we describe our vision for an ecosystem of linked solutions creating connectivity

throughout the entire value chain for gears with enhanced data collection, analysis tools and real-time feedback to the design and manufacturing process. Gleason 4.0 solutions are improving machine uptime in the form of predictive maintenance, and empowering the use of smart tools that can optimize tool costs per piece and "communicate" directly with our machines. Gleason 4.0 is also the impetus behind our Closed Loop systems for both bevel and cylindrical gears which seamlessly provide real-time data from inspection systems back to the production process to improve productivity and quality.

Machine systems will define our products of the future. Machine systems we now offer include a combination of a machine coupled with robotics or other forms of automation with other secondary operations being performed within an integrated production cell. Examples of some of the secondary operations already in our portfolio include integrated chamfering, in-process inspection, part marking and part washing.

Manufacturing globally is at a crossroads. Those that can successfully take the next step down this new technology path will prosper. We hope you consider Gleason as your partner to take that next step. We welcome the opportunity to share with you our exciting vision for the future.

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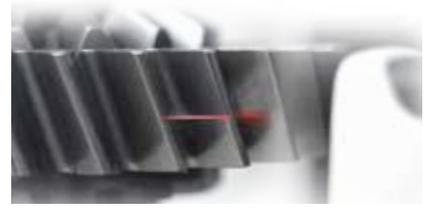
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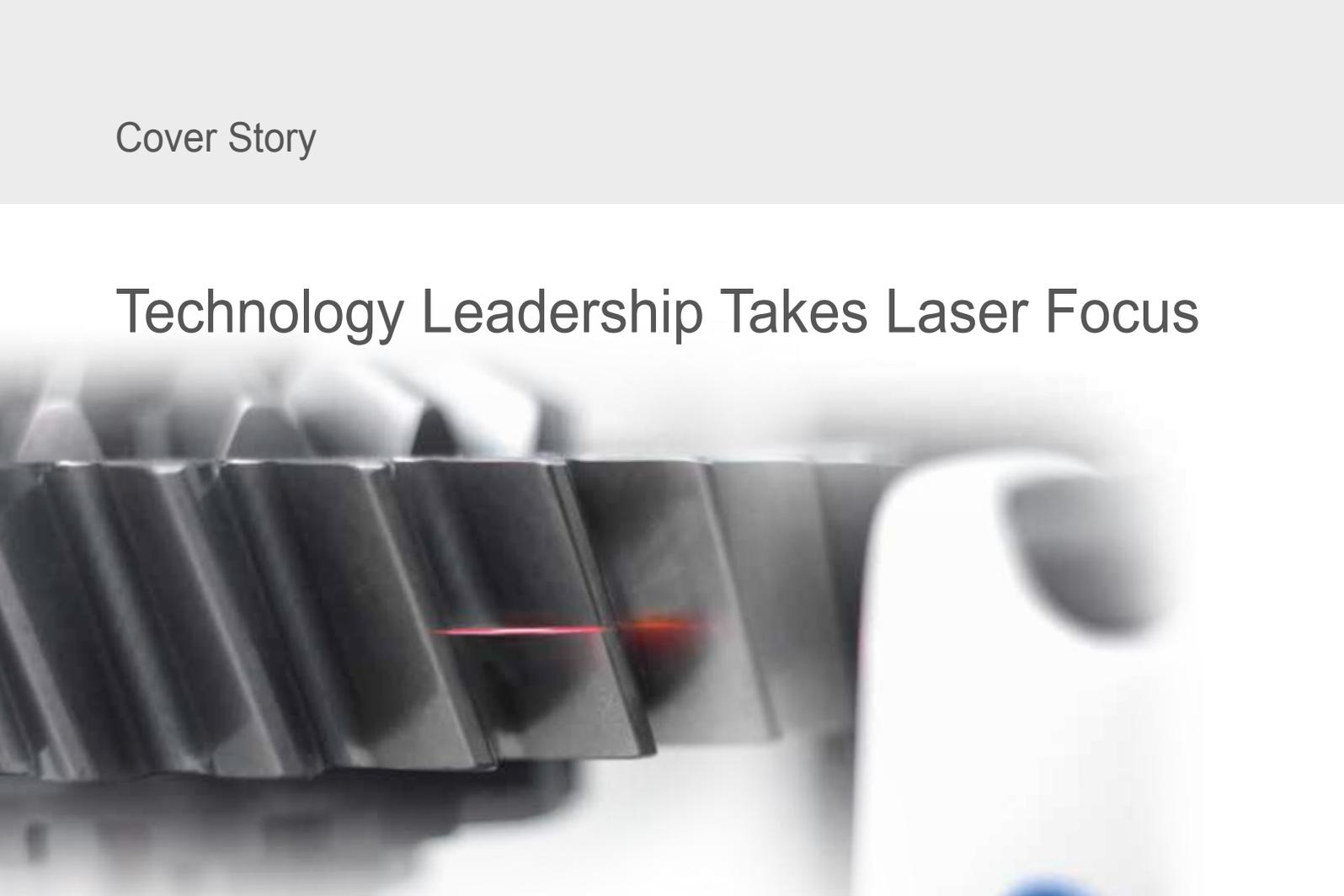
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Please address correspondence to: Christian Albrecht, Editor, SOLUTIONS.

Gleason Corporation, 1000 University Ave., P.O. Box 22970, Rochester, NY 14692-2970 U.S.A., 585-473-1000 • Fax 585-461-4348 • www.gleason.com • e-mail: sales@gleason.com

Technology Leadership Takes Laser Focus



Achieving technology leadership in gear metrology can't take place in a vacuum. Introduction of the new 300GMSL is a shining example of Gleason's 'Voice of the Customer' approach to understanding the needs of our customers and delivering technologies that meet their challenges.

Gleason's Voice of the Customer strategy is at the core of our drive for technology leadership in gear metrology. In the world of gear inspection, there are many factors to consider in understanding the needs of our customers. These include a basic understanding of the customer's part prints, analysis requirements, and the manufacturing processes used to produce the gears being inspected.

But there is so much more today. Gleason is always looking beyond the horizon at the manufacturing challenges that will exist for our customers as they develop new gear designs. Our customers can't achieve leadership by standing pat on existing gear designs. Gears are increasingly complex, as are the manufacturing processes used to

produce them and the gear boxes they go into. This means that gear measuring must be continuously improving to address the ever-changing needs of both gear designer and gear manufacturer.

The Evolution of the 300GMSL

Our Voice of the Customer strategy has resulted in the evolution of many new gear metrology system capabilities in recent years. Single-axis probes have given way to full three-dimensional contact scanning probes. Surface finish measurement probes have been made available as the hard finish processes have become more prevalent and increased the need to look at residual stresses such as grind burn. We've also put more functionality at the operator's

fingertips with an Advanced Operator Interface that offers bar code and QR code reading, video telephony, voice mail messaging and environmental monitoring.

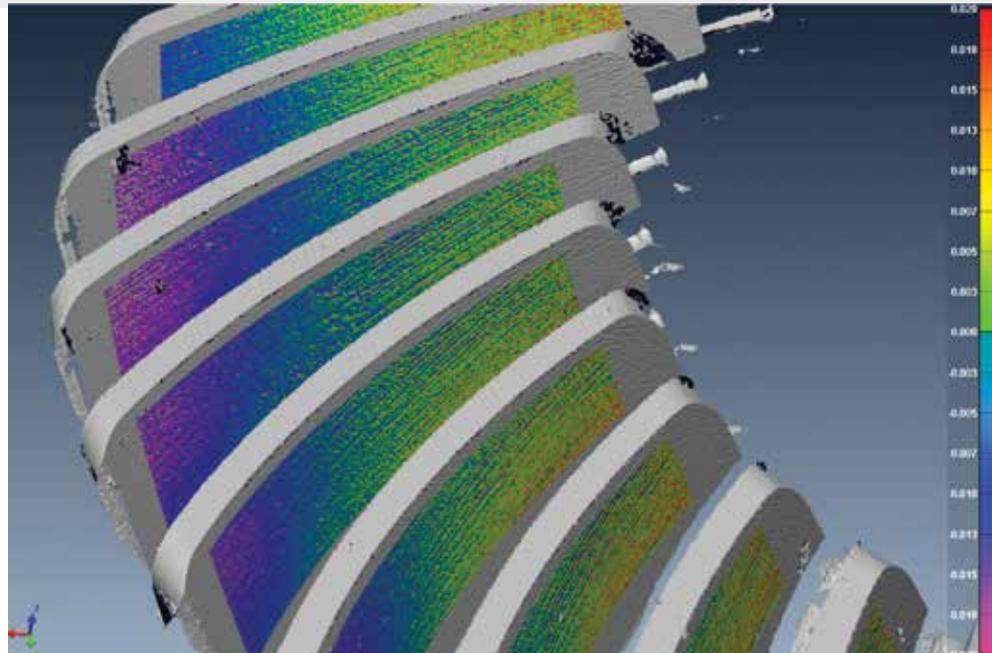
But our customers have asked for even more to help develop designs with tighter tolerances, extreme end relief conditions and surface finishes to reduce noise. In the new 300GMSL, the industry's first non-contact multi-sensor inspection system with both cylindrical gear and bevel gear measuring capability, we've delivered. By adding two indexing axes to our standard four-axis measuring machine platform, it was possible to add a laser probe to provide full flank, non-contact scanning capability for cylindrical and spiral bevel gears. Combine this with a fully

integrated 3D graphics package capable of reading as well as creating CAD files and you begin to see the potential of this significant new technology.

Gear Development Powerhouse

This single machine platform has more capability stored on it than anything inspecting gears on the market today. It is a true gear design and development tool supplied with all the capability previously offered on our standard line of gear inspection products for use in gear labs and on the shop floor. And we are just beginning to understand its full impact from the partnered customer feedback we've received to date. But we do know the power in the 300GMSL comes from a combination of **capability**, **flexibility**, **simplicity** and **throughput**. Here's how:

Capability in the fact that our customers have the ability to do the work of four machines on a single machine platform, reducing cost of ownership in less floor space consumed, less hardware to maintenance over time, less annual calibration requirements etc. Beyond its multi sensor offering, an additional capability is the significant reverse engineering power of the new 3D graphics package that can read existing customer CAD files as well as create a CAD file for those who are unable



3D laser scan of bevel gear showing traces of cutting marks which even if in tolerance can potentially result in negative noise characteristics.

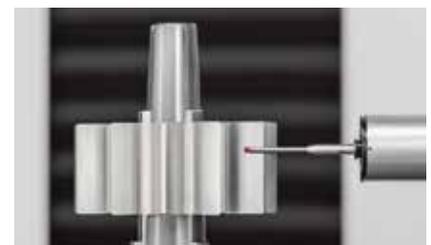
to produce one. This has proven very valuable in initial discussions with plastic and powder metal gear manufacturers in the maintenance of their molds and dies.

Flexibility is key not only in this patent pending hardware configuration, but with software as well by providing the ability to measure and display in full 3D

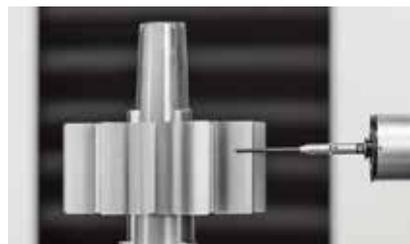
graphics mode or convert the data into standard, traditional output charts using our GAMA™ user interface software. GAMA, Gleason Metrology's Windows based applications software offers the flexibility and ease of programming manually or through the CAD interface available on the GMSL. Also included is an extensive language file to address



Laser scanning capability speeds development efforts of increasingly complex gears.



Tactile probing, for the complete inspection of a wide range of gear types, gear cutting tools and even non-gear, CMM-type measurement.

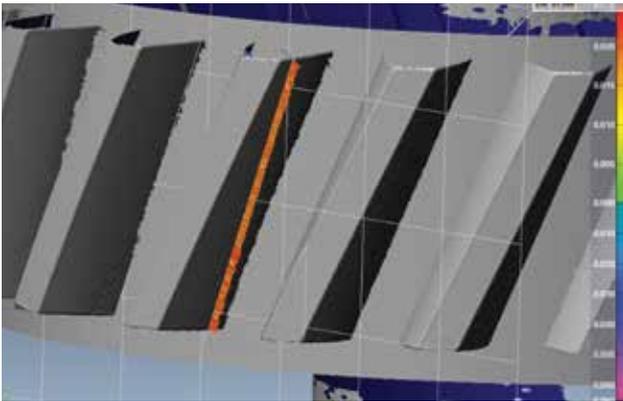


Surface roughness measurement, to help ensure consistently high-quality surface finishes.

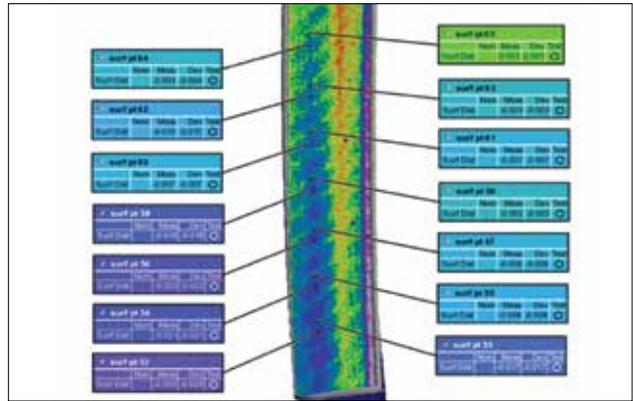


Barkhausen noise analysis, for evaluating surface modifications after finishing processes.

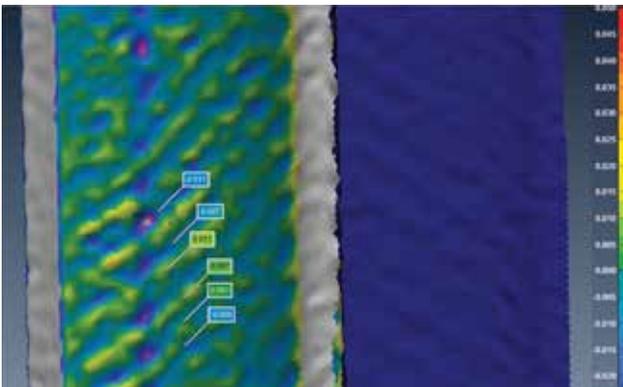
300GMSL at Work...



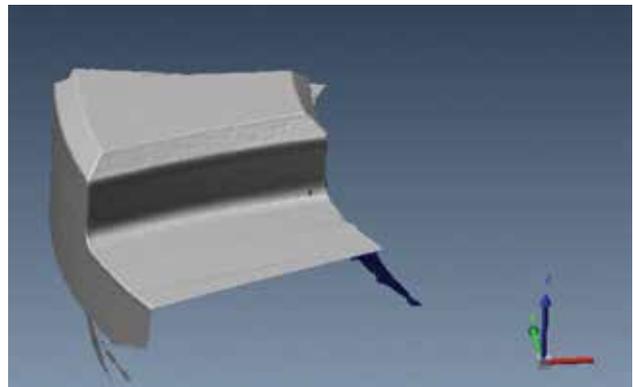
3D point cloud generated by non-contact laser probe in a single scan is analyzed and true deviations along line of contact are extracted...



...Color change then graphically depicts where the variation increases on the gear tooth. Analysis software quantifies the variation.



In this Power Skiving scallops analysis, depicting variations on the gear tooth aid in making corrections to reduce noise and tool wear.



Here, beginning a new analysis of clutch teeth and curvic coupling helps quantify mating part fit and interaction.

the needs of the global gear community. GAMA also fully supports VDI/VDE 2120 GDE (Gear Data Exchange), which again reduces the need for duplicate programming steps, allowing gear data, tolerances, etc., to be easily transferred from machine to machine.

Simplicity is offered in several elements of the design hardware and software. Standard tactile probe hardware, from the probe head to the assorted probe tips and accessories are off the shelf from Renishaw. The GAMA applications package provides simple, icon driven instructions to increase productivity from less experienced operators.

Throughput is evident when you see

the system operate with a single pass of the laser over the gear flank, taking hundreds of thousands of data points in a matter of two to three seconds. When you combine this power with other Gleason tools such as Gleason Closed Loop networking between the inspection system and machine tool, the ability to control today's manufacturing processes with much more success increases greatly.

In summary, the advantage Gleason offers with this new GMSL measuring technology is only part of the true value being brought to the market. By being part of a global team that provides the gear processing knowledge to go along

with the metrology knowledge, Gleason offers equipment, tools, workholding, services and overall value to the worldwide market of gear designers and manufacturers in over fifty countries. And the best is yet to come. Look for more solutions to your gear manufacturing challenges wherever you see the Gleason name.



Doug Beerck
Vice President,
General Manager
Gleason Metrology
Systems

Taking Power Skiving to New Levels

The enormous productivity and quality benefits of the Gleason Power Skiving process are now available for a wide range of applications. Whether you're producing small or large, internal or external cylindrical gears, soft cutting or hard fine-finish machining – there's a Gleason Power Skiving solution to fit your needs.



Most gear manufacturing applications typically fall between the two worlds of highly efficient mass production and more flexible, on-demand manufacturing of smaller, fast-changing batches. As the Total Gear Solutions Provider, Gleason has long been on the forefront of offering solutions across the complete spectrum, with systems that include gear engineering and simulation software, production machines, inspection systems, workholding, tools and supporting services.

Our approach to Power Skiving is no different. The process is recognized as a real breakthrough in gear manufacturing. It is, for example, many times faster than shaping and much more flexible than broaching. But that's not enough. Practical solutions need to exist to meet the requirements of, for example, small, complex, high-precision gears for electromobility or robotics, as well as the heavy-duty machining requirements of

large internal gears up to module 9 and diameters up to 800 mm. Furthermore, there is the need to apply Power Skiving to achieve the higher accuracy and torque for more efficient machining of hardened gears.

Only Gleason now has a complete toolkit of solutions to cover all of these requirements. Here is a brief overview...

Power Skiving of Small Internal and External Gears

Internal gears and external gears with small overrun space can be produced on the 100PS, the smallest machine in the Power Skiving portfolio in a more economic way compared to shaping or hobbing with very small hob diameters. Due to the horizontal workpiece axis



Power Skiving



configuration, the 100PS is dedicated for shaft and internal gear applications.

The 100PS can further be equipped with an integrated chamfering-deburring station working with a rotary chamfering tool. The chamfering process takes place before the last cut in order to obtain finishing quality on the flanks.

Power Skiving of Medium and Large Workpieces

For medium and large workpieces, Gleason offers the 300PS, 400PS, 600PS series of machines including an extension up to 800 mm. Combined with modular workholding in different sizes, and the extremely stiff machine concepts, Gleason can offer more reliability, shorter cycle times, and outstanding quality and surface roughness of the gear.

Still greater reductions in cycle time and tool cost/part are possible by combining a powerful P600/800PS machine with 2-station ring loader. The machine features a process which uses a cutter with inserted carbide blades for roughing, and a PM cutter with integrated deburring capabilities for finishing. The changeover from the roughing to the finishing tool is done with an automatic tool changer.

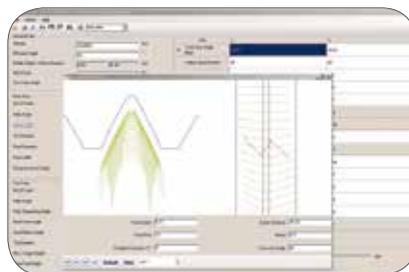
Ultimately, the quality of the parts produced by this system is superior to what's generally possible with processes like shaping or internal milling, at lower tool cost/part.

Powerful Process Simulation

Until recently, it was impossible to effectively establish the boundaries at which the skiving process exceeds its limits and isn't effective. Nor was it possible to truly optimize the process in advance due to the lack of appropriate software. Anticipating and evaluating chip formation and collision points was difficult, if not impossible.

Today however, Gleason offers comprehensive Power Skiving Technology and Simulation Software that enables end users to easily simulate the entire cutting process and determine the most effective process strategy.

The software can analyze the influence of different cutting tool geometries and process parameters on chip formation, gear quality, collision situation and cycle time. Now, the total cost per gear can be calculated, factoring in the optimum cutter size, the cost for a new cutter, and the cost for resharpening in combination



Before the first chip is removed, Gleason's process and application specialists know the results using powerful simulation software.

Application Examples		
	100PS	600PS
Module	2.2 mm	9.7 mm
Number of teeth	20	60
Helix angle	32.5° right	0°
Cutting time	41 seconds	26 minutes

with anticipated cutter life. The software allows end users to decide if a given part can be safely and economically manufactured by Power Skiving or whether shaping is the better process.

Design of Power Skiving tools is always based on a simulation and technology requirements. This differentiates Gleason from competitive suppliers. Ultimately, it makes the implementation and application of Power Skiving as simple and familiar as shaping.

Hard Power Skiving

The requirements for quieter gears and/or higher torque are increasingly driving the need for fine finishing of hardened gears. Until now, the hard finishing solutions available for small and medium internal gears were not efficient – and very costly. Power Skiving and Gleason's process know-how are opening up exciting new hard finishing possibilities for internal gears. Testing has indeed proven that Hard Power Skiving is a stable process delivering very good results in terms of quality, surface structure, cycle time and tool cost per part.

While it's true that Hard Power Skiving today is fast becoming a practical reality, the process is still in its initial phases. It is recommended that, for the best possible results, interested customers perform process development together with the specialists from Gleason.

Power Skiving



Cutting Tools and Tool Management

Carbide tools are designed and manufactured by Gleason application specialists in close collaboration with Gleason Cutting Tools operations. The carbide cutter for Hard Power Skiving and the cutter for Soft Power Skiving need to match in order to provide the optimum result and cutter life.

Setting of the cutter is done with the help of a specially developed 160CPS Cutter Positioning System (shown below). This not only allows the setting of the cutter

in an optimum way, but also allows the analysis of the wear of the cutter through an integrated microscope and PC. More important, it is equipped with an RFID reader, which allows reading the data from an RFID chip included in the cutter. This is part of the Gleason 4.0 initiative called gTools.



The Hard Power Skiving machines are equipped with a stock dividing sensor to detect the position of the tooth gap.

Bevel Gear Cutting Machines

For customers with low gear volumes who can't perhaps justify dedicated Power Skiving machines – but already have bevel gear cutting machines – Gleason can offer Power Skiving solutions as an add-on to these bevel machines. Different cutter systems, including solid carbide cutters, cutters with inserted carbide blades and stick blade cutter systems are part of the 'Total' Power Skiving Solution from Gleason.

Closing the Loop on Quality

For many years, Gleason has developed closed loop systems for our bevel gear manufacturing systems. 'Closed loop' optimizes gear production by connecting the Gleason production machines to Gleason inspection equipment. A similar software capability exists for Gleason Power Skiving machines in connection with Gleason's line of GMS[®] metrology equipment. Measurements and corrective actions can be performed quickly in an automatic mode, monitored by the operator.

In conclusion, it's gratifying to know that the enormous potential of Power Skiving is finally being realized. Even more developments are ahead. Stay tuned...



Udo Stolz
Vice President
Worldwide Sales
and Marketing
Gleason Corporation

Bevel Gear Design Power at Your Fingertips



GEMS

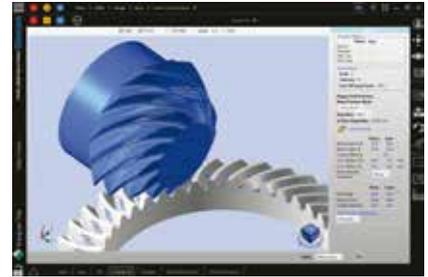
With GEMS™, we've introduced the next-generation design and manufacturing system for bevel gears and some specific types of cylindrical gears. It's a powerful new software platform that provides highly desirable gear design and analysis capabilities, seamlessly connects with all your existing Gleason design software – and helps optimize the complete bevel gear manufacturing process.

GEMS is the world's first gear design software that can be operated entirely via touch screen. It is also fully compatible to keyboard and mouse operation for instantaneous changeover between, for example, an initial touch interaction and keyboard to enter numerical data during a tooth contact optimization. GEMS software also works equally well on a tablet or a smart phone.

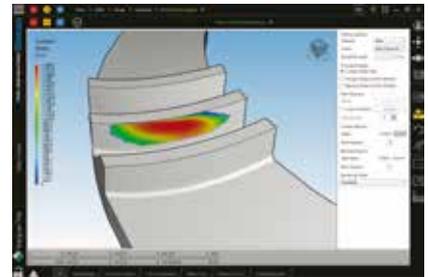
GEMS easily connects to the entire Gleason program suite as well as institutions and associations. This makes it possible to check some AGMA standards or run a chip formation study with the WZL tool box from within GEMS. GEMS might be the only software application a gear engineer will ever need during a working day.

In addition to the many user interface and data processing innovations, GEMS offers a large variety of new gear engineering capabilities and 3-D graphics that make the gear design and manufacturing easier and allow better decisions. The analysis capabilities and the easy-to-understand graphical representation open possibilities for creativity and the potential for extraordinary accomplishment.

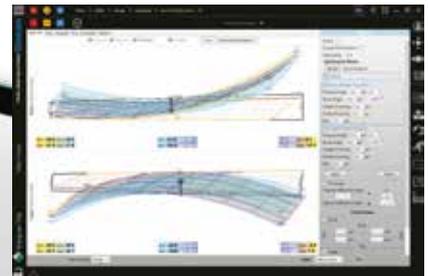
3D Tooth Contact Analysis



Strength Calculation: FEA Analysis, Contact Stress



Ease-Off Modification



KISSsoft AG Joins Gleason



synergies and provide our customers greater value by linking design and manufacturing expertise, having the potential to radically improve the efficiency of designs and the manufacturing solutions optimum for those designs. The KISSsoft team has developed a strong base of loyal customers that we look forward to serving together with KISSsoft.”

Background...

In the early 1980s, Dr. Ulrich Kissling developed a calculation software for his family company, gearbox manufacturer L. Kissling & Co. AG. Called KISSsoft®, the software was originally intended for purely in-house use, but quickly spread to other mechanical engineering sectors, and was implemented by a growing number of firms.

Over time, demand for KISSsoft became so great that an independent company – KISSsoft AG – was founded in 1998, to maintain, develop and market the popular product. Since then, KISSsoft AG has continued to grow steadily. The company is headquartered in the idyllic Zürcher Oberland region of Switzerland. For more information about the company and its products visit: www.KISSsoft.AG.



The KISSsoft Management Team:
Dr. Ulrich Kissling (Founder and CEO) and
Dr. Stefan Beermann (CEO)

In February, Gleason acquired KISSsoft AG, headquartered in Bubikon, Switzerland and a leader in the development of design software for gears and power transmission systems.

KISSsoft is best known for its modular calculation program for verifying, optimizing and sizing machine elements. The application ranges from handling simple machine elements to automatic sizing. It performs strength calculations

quickly and accurately, and provides detailed documentation, including safety factors and service life values. The KISSsys system additionally can be used to model complete gearboxes and drive train systems.

Dr. Ulrich Kissling, the founder and Chief Executive Officer of KISSsoft, says: “We are excited about our future partnership with Gleason. Given Gleason’s mission as a Total Gear Solutions Provider, its strength in bevel gear design and its position as a world leader in gear manufacturing and metrology solutions, the potential opportunities to provide our customers with new solutions is compelling. In addition, Gleason’s global reach and long-time customer relationships will open up new doors for our products.”

John J. Perrotti, President and Chief Executive Officer of Gleason Corporation, adds: “KISSsoft joining Gleason will deliver significant



One Machine, All Types of Large Gears



Gleason-HELLER 5-Axis Powerhouse

Now 5-axis machining of larger high quality gears in low volumes has never been more productive than with a new generation of Gleason-HELLER machines.

These machines can easily produce all types of gears and gear tooth geometries – everything from spiral and hypoid bevel gears, straight bevel

gears to spur, helical, double-helical and herringbone cylindrical gears – and perform all the other general machining tasks typically required of 5-axis machines. The end result is the nearest thing yet to a universal 5-axis machine.

Several 5-axis horizontal-spindle machining centers now comprise the Gleason-HELLER line, ranging from the 6000 series for workpiece diameters up to 1,000 mm, to the FT 16000 for workpiece diameters as large as 2,500 mm. The inherent static and dynamic stability of the HELLER machine platform and its extremely robust, high-torque/high power spindle design provide the ideal platform for the application of a wide range of highly productive inserted-blade disk-type cutters.

Most significantly, the new Gleason 5-Axis Gear Studio (G5S) software system seamlessly interfaces with the HELLER uP-Gear CAM system, providing all the input data, corrections and flank modifications needed for uP-Gear to generate a 3D geometry model of the gear for visualization, and the optimum NC parts program needed to produce it. Ultimately, machining a gear complete from a blank can now take place in as little as two to three hours, vs. the two to three days needed with a standard 5-axis milling machine using end mills.



New Solutions for Metrology



Gear Inspection for the Shop Floor

Now manufacturers of complex, high-quality gears can eliminate quality lab transport and queue time with the 300GMSP and new 475GMSP Gear Inspection Systems. They're designed to withstand factory floor temperature, vibration, and contamination variations and work alongside production machines – while delivering lab-level inspection capabilities.

The GMSP machines can also be interfaced with the Gleason Closed Loop System, which allows measurement data to be networked from the inspection machine directly to the latest Gleason production machines. With Closed Loop, it is no longer necessary to transfer the necessary measured values manually, a process which often leads to costly errors and wasted time during setup. The path to first-part qualification is now much more efficient, enabling the production machine to quickly compare inspection data with nominal values, calculate the corrections required, and produce a qualified first-part.

Features include:

- Complete gear inspection, from fine pitch gears as small as .2 module, to shaft-type gears up to 450mm in length, as well as surface finish measurement on gears down to 1.2 module. Even capable of 3D measurement.
- GAMA 3, the object-oriented Windows® compatible operating software that puts a host of powerful features right at the operator's fingertips, creating a simple, intuitive human/machine interface.
- Compact, highly ergonomic, with variable workstation placement.
- An Advanced Operator Interface (AOI) with dual display SPC, voice, photo, video, QR code/barcode read/import, and environmental monitoring/recording.
- High accuracy 3D scanning probes and convenient, easy access probe storage. A 6-position Automatic Probe Change (APC) is also available.



New Solutions for Service

Gleason Global Services is developing several powerful new technology tools to help customers avoid the high cost of unplanned downtime – and quickly remedy problems when they do occur.

Delivering faster customer service and better results are the primary 'drivers' in the development of several new Gleason Connect® technologies in the Gleason 4.0 portfolio. In particular, more powerful tools are needed to help take time and effort out of the diagnosis and evaluation of the condition of mechanical components. Fortunately, exciting new technologies are fast becoming available. Here are two of the latest:

Gleason Fingerprint: Identifying Problems Just Got Easier

The accurate data needed for predictive maintenance is often unavailable, or can only be obtained with great effort. Ideally, the systematic analysis of the status of a machine could take place without first sending a technician. Now, by using Fingerprint, the condition of a machine's most important mechanical components can be diagnosed and evaluated from anywhere in the world, via Gleason Connect. Importantly, it can be done without the disassembly/



reassembly usually needed to perform a machine assessment. The data supplied by Fingerprint provides an up-to-date status report of the machine's mechanical components. An assessment of machine condition can be done at any time.

Before a machine is shipped to the customer, a Master Fingerprint cycle collects data and creates a master reference. This Fingerprint cycle will later be used as a reference for inspection and fault analysis. Fingerprint can generate an accurate analysis in far less time, with a fraction of the cost and effort, and without requiring a skilled technician as the first step. Ultimately, checking on the machine's status, performing self-checks, and recommending action can all be done proactively.



Gleason Connect +: Augmented, Fast, and Smart

They're called 'Smart Glasses', and they connect to the internet to provide picture and sound. This Augmented Reality (AR) capability is now part of Gleason Connect + Services. It's an important new tool that allows the customer and/or Gleason field service engineers to be hands-free and receive the live data they need to deal quickly and effectively with service issues directly from the service office in real time via the glasses. It will become an increasingly popular way of communications and remote field diagnostics by giving service technicians the ability to react faster and with even greater precision.

Better yet, the scope of Smart Glasses' application in daily service activities is potentially very large. Imagine, for example, the benefit of using the glasses in a training classroom, and receiving pertinent technical details and instructions from experts all over the world in real time!



Robert Peyr
Product Manager
Global Services

New Workholding for Faster Bevel Gear Development



Bevel gear manufacturers now can greatly reduce the time it takes to get fully functional, extremely accurate workholding for their gear testing and development efforts, with Gleason's new FLEX-SPAND™ (gears) and FLEX-GRIP™ (pinions) workholding solutions.

Without sacrificing functionality or typical workholding accuracies of ± 0.005 mm (0.0002") total indicator reading, just three standard size modules can meet the requirements of gears and pinions

ranging in size from 3.5" in diameter up to 8" in diameter. For gear development and short-run prototyping or even some production, users now need far fewer Gear Lab workholding systems, on order or in inventory, for a wider range of gears.

FLEX-SPAND and FLEX-GRIP function much like the other bevel gear workholding in Gleason's wide array of solutions, where a workpiece is chucked firmly in place when the production

machine's draw rod pulls back on an expander in the arbor to actuate the collet that grips the gear. The gear is, at the same time, pulled securely against a backing ring to ensure precision. In the case of FLEX-SPAND and FLEX-GRIP, however, the expanding collet has been replaced with a set of bolt-on, interchangeable jaws to perform the clamping function, and one backing ring can be used for a wider range of gear diameters. While the application of standard workholding is inherently limited by the exact gear diameter that its collet and backing ring were designed for, the use of interchangeable jaws design means that jaws can be easily ground to accommodate a different gear diameter and changed out in an existing arbor much faster and at less expense than ordering a completely new system.

The systems can be applied to Gleason bevel gear cutting and grinding machines for both soft cutting and hard finishing of gears and pinions, as well as Gleason bevel gear lapping and testing machines – and non-Gleason machines – with workspindles that have a Gleason-type taper.



Quik-Flex® Plus: A Change Will Do You Good

Increased spindle time, more productivity and lower cost per workpiece are just a few of the many benefits users can experience with the new Quik-Flex® Plus, Gleason's latest generation of modular, tool-less and extremely accurate workholding solutions for cylindrical gears and pinions:

- Cuts gear changeover time to just 30 seconds or less.
- Eliminates all the usual tools and hardware.

- Helps ensure exceptional accuracy and repeatability.
- Available in different modular sizes to meet the requirements of various processing applications on both Gleason and non-Gleason machines.



New Facilities



Gleason President and Chief Executive Officer John J. Perrotti kicks off the Grand Opening and Ribbon Cutting Ceremonies.

Gleason Expands in India

On August 17th and 18th, 2017, Gleason hosted more than 150 customers and business partners for the grand opening of its new 65,000 square foot facility in Aerospace Park, Devanahalli, Bangalore, India. Gleason's first production facility in Bangalore was established in 1996. Since then, Gleason's presence in India has grown, keeping pace with the country's remarkable industrial growth. This larger, more modern, climate-controlled facility will allow Gleason to provide a

wider range of high precision products produced in India for both local and global customers.

John J. Perrotti, Gleason President and Chief Executive Officer, said, "The investment in this new facility makes an important statement about our belief in the Indian market and its growth potential, but most importantly it is recognition of our confidence in our Gleason Team in India to serve our customers at the highest level."

Products produced at the new Bangalore facility include the Genesis® Series Gear Hobbing Machines, the new 200SVP Gear Shaving Machine, remanufacturing of a wide range of Gleason machines, design and production of bevel gear cutting tools and gear shaving cutters as well as sharpening services for bevel and cylindrical gear cutting tools, workholding products and an array of training programs, spare parts, customized service programs and technical support.

...And in Studen, Switzerland

A new facility in Studen, Switzerland, scheduled for launch later this year, will help Gleason keep pace with both growing demand for current products as well as accommodate strategies for future growth. At this new 4,650 m² facility, Gleason will produce horizontal and vertical hobbing machines for gears with diameters up to 250 mm, including the existing product portfolio, the Genesis® series and future products, as well as Gleason Automation Systems.





**SEW
EURODRIVE**

Producing the Gears That Drive the World

Gleason technologies are helping SEW Eurodrive meet unprecedented global demand for the compact, quiet and very high-efficiency spiral bevel gear units that drive everything from your luggage on an airport conveyor to the process automation that fills the bottles of your favorite beverages.

Ask Chuck Chandler, plant manager at SEW Eurodrive USA's Lyman, South Carolina plant about the range of applications for the spiral bevel gear units produced there and his response is simple: *the world*. The ultra-modern 385,000 sq. ft. facility – winner of Plant Engineering Magazine's **Top Plant Award** in 2007 – is running three shifts a day, six days a week and busting at the seams to keep pace with record demand from SEW Eurodrive Assembly Centers around the world. But if you think these production challenges keep Chandler up at night – guess again. “We've never been more productive or efficient,” he says, “And we have some of the latest Gleason technologies helping us get there. It's a good problem to have.”

Grinding for More Precision

Ten Gleason Phoenix® bevel gear cutting machines, including four of Gleason's latest generation of 280CX machines, produce all of the spiral bevel gear sets used in SEW Eurodrive's popular K Series of right-angle gear units. The K Series is an industry workhorse, renowned for delivering 96% efficiency and very quiet, wear-free performance across a 200 to 50,000Nm torque range. These gears are heat-treated and then lapped and tested on Gleason HTL

The 280G eliminates pipes, wiring and clutter from the work area so that swarf containment and evacuation is extremely efficient. Quick-change coolant headers speed setup and ensure optimum coolant delivery.

TurboLapper and HTT TurboTester machines. But with the introduction in 2004 of a new family of servo gear units, designed for very high precision applications where positioning tolerances are often measured in microns, Chandler and his team recognized that lapping these gears as a hard finishing process wasn't going to be good enough. “The



Phoenix® 280G

spiral bevel gearsets in these servo gear units must be produced with very tight tolerances and operate backlash-free, so we opted to finish grind them,” Chandler explains. “Plus, by grinding gears and pinions independent of each other rather than having to lap them as mated sets, we have the added flexibility of finishing gears or pinions in the optimum lot sizes and on demand.”

Early on, SEW Eurodrive relied on Gleason and their Phoenix® 280G Bevel Gear Grinding Machines to grind the gearsets at Gleason. “We didn’t initially have the volumes or, frankly, the grinding expertise, to justify a grinding machine purchase,” Chandler recalls. “Outsourcing to Gleason gave us a chance to learn about the process and see firsthand how well the 280G performed, so when the time came we bought one right off the floor at IMTS 2014.”

Proven Phoenix Performance

Today, this 280G is helping meet the world’s growing appetite for SEW Eurodrive’s servo gear units – and performing so well that Chandler and his team are looking at a second machine and more opportunities to apply grinding, whether for noise reduction or to squeeze more torque out of a smaller gearset. The machine’s exceptional reliability has come as no surprise to Chandler, since the 280G is built on the same platform as his tried and true Phoenix 280CX cutting machines. It also features an exceptionally well-designed work area for swarf containment and evacuation. This is critical for ensuring fast, accurate bevel gear grinding, as well as helping to minimize the time-consuming and expensive maintenance challenges of swarf accumulation and contamination. Virtually all of

SEW Eurodrive relies on Phoenix® 280CX Bevel Gear Cutting Machines to produce most of the spiral bevel gearsets used in the popular K Series gear units.

the usual wires, piping and even the door rails have been moved out of the work area and put behind guarding, so swarf is easily contained and falls free for collection by the coolant chute positioned directly below the work area. In addition, the 280G is equipped with an integrated dressing unit with a unique telescoping design that enables it to extend into the work area for dressing, and then fully retract flush with guarding during the grinding cycle.

But what Chandler also appreciates now is just how productive the 280G is. “We’re producing 24 different gears and pinions in the servo gear family, and once you set it up for a part for the first time, replicating that same part setup downstream is very fast and easy,” Chandler says. He attributes some of this setup speed to the color-coded sets of quick-change coolant headers that allow the operator to easily optimize the flow of coolant for each part, critically important in order to avoid surface defects and achieve the desired surface finish and flank form accuracy.

The machine is also equipped with a quick-change grinding wheel spindle design, as well as a work spindle that allows conventional arbors to be installed to, and removed from, the front of the machine. All of these setup tasks are performed by the operator without



Load/unload automation is easily integrated with the 280G, further reducing non-productive time.

tools. Non-productive time is further reduced through use of an automatic stock divider, mounted in close proximity to the work spindle, that operates simultaneously with wheel dressing.

Easily Automated for More Efficiency

As you’d expect, SEW Eurodrive makes extensive use of automation. Robotic load/unload is used on 90% of the gear cutting machines, and was easy to integrate on the 280G. “Our studies show that manual load/unload is, at best, about 72% efficient, which means a



machine will be waiting a lot," Chandler says. "On the 280G, we use the robot to not only load and unload the machine, but also to hold the part for cleaning and pick and place the part at laser etching and palletizing."

Automating Cutter Build

Perhaps the only productivity stone left unturned at the Lyman plant, until recently, was in the tool room, where as many as 25 cutter systems are built every three-shift day to meet the needs of 12 bevel gear cutting machines. True, tool room operators make good use of two highly productive Gleason BPG Blade Grinding Machines and a GBX Blade Inspection System to quickly and efficiently sharpen and inspect all



Gleason 500CB Cutter Build Machine eliminates costly tool room bottlenecks and frees up valuable manpower by automating time-consuming cutter build and inspection operations.

the carbide stick blades used in these Gleason Pentac® or older Gleason Tri-Ac® face hobbing cutter systems. But much of the operators' time was spent building, truing and inspecting the cutter heads, a process that, according to Chuck Chandler, took upwards of 90 minutes per head and could result in costly blade misalignments and blade chipping despite the expertise of these technicians. So it's not surprising that, 18 months ago, Chandler took advantage of the opportunity to make his tool room the first beta site for Gleason's new 500CB Cutter Build Machine. "It's inevitable that building, truing and inspecting cutter heads manually will result in the occasional blade misalignment, but even one is too many," Chandler explains. "This can cause a chipped blade downstream, and drastically reducing tool life as a result. Now, with the Gleason 500CB,



500CB's closed-loop system corrects for blade movement during automatic clamp screw torquing and provides 'intelligent' feedback for more precise truing.

all of those manual steps are performed automatically and with greater precision and repeatability by the machine. A process that once took 1-1/2 hours now can be done in 30 minutes or less, and we're no longer worried about misalignments and chipping blades. Plus, we've freed up our tool room people so they can be productive while the 500CB is doing its thing."

Less Work, Better Results

The new Gleason 500CB Cutter Build Inspection Machine is the first machine

of its kind to fully automate most of the critical steps in the cutter build and truing process. Its predecessor, the Gleason CB machine has, for years, been a solid workhorse in tool rooms worldwide, and succeeded in lifting some of the burden from the operator's shoulders by automating a few of the critical steps in the build sequence. But the 500CB goes much further than the original CB or, for that matter, any other machine on the market.

Now, after cutter build data is input, all the operator does is load the cutter head, position the build carriage, and

500CB



SEW Eurodrive was the Beta site for Gleason's first 500CB machine. Today, the machine is reducing cutter build times from the 90 minutes needed previously to less than 30 minutes.

load the blades into their respective slots. Next step? Press GO and walk away, with 30 minutes or so of precious time now available for other tasks. Now, all the other steps that have taken so much time, and been so dependent on the operator and his expertise are performed automatically by the 500CB. Blades are positioned in their slots, clamp screws precision-torqued, and blade axial and radial position measured. As this process unfolds, the 500CB actually learns from the measurement feedback it receives, and loosens, tightens and measures blades

again as needed – just as the technician would do – until blades are trued to their optimum radial and axial position down to +/- 2 microns if needed. It's an adaptive process too, with the 500CB learning from every build to optimize future builds.

If the operator chooses to, he can view a screen on the machine's CRT charting every blade's position and runout in real time. And, at any point in the process, start to finish, the operator can use the intuitive operator interface with software 'Wizards' to guide him through every step of setup and operation.



Blade position and runout are charted in real time, enabling the operator to easily monitor a build as it progresses.



Once the operator has loaded the cutter head, positioned the build carriage and loaded the blades, he's free to perform other tasks while the 500CB completes the build, truing and inspection operations.

According to Chandler, the 500CB's impressive functionality isn't limited to just a few cutter systems types or sizes either. It can be easily applied to both newer Pentac® cutter systems and the older Tri-Ac® cutter heads still in use, as well as the wide range of cutter head diameters running on SEW Eurodrive's cutting machines, from as small as 70 mm (2.75") to as large as 533 mm (21").

About SEW Eurodrive

With 17,000 employees worldwide and sales of EUR 3.0 billion, SEW Eurodrive is a world leader in delivering thousands of drive system solutions using a comprehensive modular system for building gearmotors and frequency inverters, servo drive systems, decentralized drive systems, and industrial gear units. For more information, visit: www.seweurodrive.com.

Closing the Loop

Connecting GMS Metrology with GX Hard Finishing – Fast, Reliable and Highly Automated

Producers of automotive gears have told us that, in a perfect world, the time needed to set up and begin hard finishing a new gear series in quantity after producing the final gear of the previous lot would be **zero**. While this isn't currently achievable, our new GX Threaded Wheel Grinders, operating in a Closed Loop with Gleason GMS inspection systems, come the closest yet.

Setup Time Is Minimal, and 'Seeing Is Believing' at GX Days

Judging by the excitement that we've generated among attendees at our GX Days, events staged worldwide that have enabled us to conduct hands-on demonstrations of the GX series and Closed Loop, we've succeeded in fulfilling a host of long-sought user benefits – many related to minimizing costly non-productive time. It's particularly gratifying when an attendee tells you that a machine as productive as the GX is also, "As easy to set up as a photocopier."

The GX certainly makes significant reductions in chip-to-chip time with its double-spindle design, which allows for load/unload in parallel to the grinding cycle. It can also be easily integrated with an impressive array of Gleason

A do-it-yourself demonstration at GX Days gives customers a chance to set up the machine in a few simple steps: "As easy as a photocopier."



Automation solutions that make further reductions in overall cycle times. These include Gleason Automation Systems' Machine Tool Loaders with robotized palletizer units that take up considerably less space than conveyors, and a variety of modules for spinning, roll-checking, laser marking, SPC and NOK stations.

Less obvious, but very important, is a new design detail that's deceptively simple: setup with a single tool. This means that the operator needs just one universal tool to change the grinding wheel, dressing tool and workholding. Grippers on the automation are exchanged with no tools. In addition, the operator is guided every step of the way by menu-guided setup that, at GX Days, enabled even attendees with no operating experience to easily set up the machine.



GX Series



Double spindle concept for short idle times.

Finally, the operator is aided throughout the process by a setup trolley that puts heavy components like grinding and workholding modules right at his fingertips.

Getting It Right the First Time

The GX's new 'First Part Cycle' then automates the usual workflow that follows mechanical setup, up to and including grinding the first two new workpieces. This process is typically done manually start to finish. With First Part Cycle, operator involvement ends early, right after he sets the ideal position for the coolant nozzles using an NC-controlled

hand wheel. Automatic coolant nozzle adjustment then ensures that once found, this position is maintained even if the diameter of the grinding wheel becomes smaller. First Part Cycle takes over from this point forward, freeing up the operator for other important tasks. The dressing tool is engaged fully automatically into the gaps in the grinding worm. A sensor integrated in the grinding spindle is combined with the corresponding algorithm to make this process fast, simple and, above all, reliable. The grinding worm is given its first dressing immediately after the dressing tool has been positioned to the grinding worm. After the initial dressing,

Simple Setup...



Setup is simplified with one single tool, and a setup trolley.



the worm is engaged with the workpiece. Once the workpiece is engaged, it is then measured by the index sensor and serves as a reference for all the following workpieces. First Part Cycle is completed by grinding two workpieces, one on each workspindle, which then are discharged automatically for inspection into the SPC station that's integrated into the Gleason Automation system.

Highly Desirable Grinding Technologies...



Sandwich worm grinding wheel for polish-grinding.



Gear with mirror-like surface.



Surface texture with VRM-grinding.



Surface texture with conventional grinding.

A New Twist on Topography

The GX also saves time with Twist-Controlled Grinding, a process that, in double-flank grinding mode, can produce different amounts of twist on the left and right flanks simultaneously without the additional grinding cycle time typically required. Counteracting the twist, or bias, which occurs when grinding helical gears with lead modification without adding time or complexity to the operation is a real GX advantage.

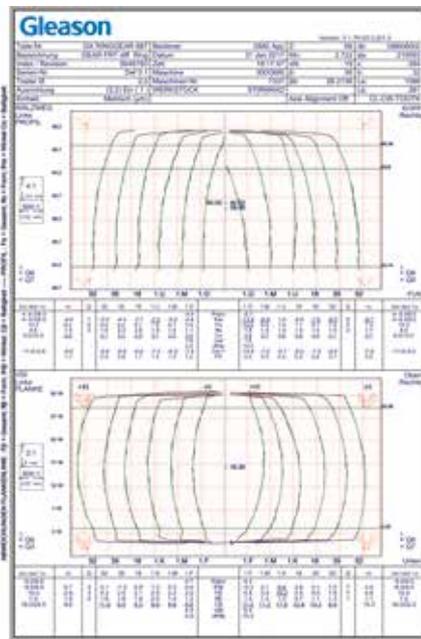
Several other important grinding processes are available as well on the GX, to meet our customers' needs for improved surface finishes. For example, as emissions and fuel consumption

standards have toughened, we've seen an increase in applications where gears with mirror-like surface finishes are desirable. For that, the GX uses a sandwich worm grinding wheel consisting of two sections – one for grinding, the other for polishing. Bond type and grit size of each section are optimized to match the distinct requirements of both grinding and polishing.

The GX also can apply Gleason's proven Variable Rate Method (VRM) to help achieve a surface texture that will have a positive effect on the noise emission characteristics of ground gearsets.

Closing the Loop, Connecting to Quality

Most importantly, the GX seamlessly networks with a Gleason GMS Gear Inspection system via the Gleason Closed Loop process. With Closed Loop, it is no longer necessary to transfer the required measured values manually, a process which frequently leads to costly errors and wasted time during setup. Production is faster and more reliable as a result. The GX automatically compares the data transmitted with the nominal values and automatically calculates the corrections required.



An example of GX's ability to grind a different twist into both flanks in double-flank mode.



Dr. Antoine Türich
 Director Product Management
 Hard Finishing Solutions
 Gleason Corporation

Chamfering/Deburring



The Bold New World of Chamfering and Deburring

Chamfering and deburring are finally getting the respect they deserve, with ingenious new technologies take the pain out of applying these important auxiliary processes.

The P90CD features an integrated chamfering/deburring station to perform chamfer/deburr in parallel to hobbing, thus achieving a cycle time of just 10 seconds chip-to-chip.

If there's a 'red-headed step child' among the cylindrical gear manufacturing processes today, it's chamfering and deburring. Since these operations historically add cost and time to the production process, but practically no value, they generally go unloved, underappreciated and even ignored. But manufacturers that underestimate their importance do so at their own risk, particularly in hyper-competitive industries like automotive, where premature transmission failure, less-than-optimal fuel efficiency, or unacceptable noise can result from application of transmission gears operating with anything less than a flawless tooth flank. For both gears and shafts, generating a chamfer to precise customer specification for size, shape and angle is of critical importance in order to minimize the potential for sharp, brittle edges after heat treat, as well as to optimize material plus conditions in the tooth flank prior to the hard finishing operations. Chamfering and deburring are particularly critical in advance of the honing process, where excessive stock and hardened burrs can greatly diminish honing tool life and, as a result, significantly increase cost per piece. Chamfering and deburring also help to reduce the health and safety risks that can result from operators handling parts with sharp burrs.

Fortunately, new machine designs, processes and cutting tools are today converging to make chamfering and deburring as easy to apply, and just as desirable, as the primary soft and hard processes. Here's an overview of several important technologies, and how they're being applied.

Chamfer Rolling

Chamfer rolling, also known as rotary deburring, is an extremely fast, versatile process that's most often applied to smaller cylindrical gears up to module 5 mm to remove the burrs formed by a preceding soft gear cutting operation. Chamfer rolling is a forming process which creates chamfers along the tooth

Chamfering/Deburring



A two-cut process is executed in a single setup (cutting-chamfering/ deburring-cutting) and eliminates secondary burrs and residue on the gear flanks. It benefits subsequent hard-finishing processes and protects the tool life of expensive finishing and dressing tools, particularly honing.

edges with gear-shaped tools which mesh with the workpiece. Excess material flows mainly to the face side of the gear, where it's then cut away by single blades, deburring discs or file discs, depending on gear shape and/or machine configuration. However, small amounts of material can also flow into the gear tooth flank itself, thus forming a secondary burr. While the shaving and threaded wheel grinding processes can easily remove this material, a subsequent honing operation will necessitate that this secondary burr be removed by either edge zone burnishing or a two cut-hobbing process prior to honing – or run the risk of compromising expensive honing tool life.

While chamfer rolling has historically been applied using dedicated stand-alone machines, today chamfer stations are often integrated into hobbing, shaving and Power Skiving machines so that the process can be applied either in parallel to the cutting operation with no additional chip-to-chip time -- or sequentially when a two-cut process is required. A good example of chamfer rolling in parallel with hobbing is the new Gleason P90CD Hobbing Machine. By performing chamfering/deburring in

parallel with hobbing, it can deliver a remarkable cycle time of just 10 seconds chip-to-chip, with the assistance of high-speed gantry load/unload automation and Gleason workholding with a very fast clamp/ unclamp capability. The gear is hobbed and the rough burr that results from hobbing is removed in a single setup. The gear then is unloaded by the gantry and loaded into the chamfering/ deburring station, where chamfer rolling with deburring is performed simultaneously while another gear is hobbed. Note that if the subsequent finishing operation does not allow any burrs in the flank , it may be desirable to apply special Gleason chamfer rolling and burnishing tools at this station that feature a 180° chamfering section and another 180° section with burnishing functionality. Secondary burrs on gear flanks generated by chamfer rolling tools

A new generation of chamfer rolling and deburring tools are available to meet the particular requirements of every process, as well as the customer's particular application. Solutions range from simple chamfer tools to highly sophisticated solutions with edge zone burnishing options.

are rolled down into the flank surface leaving only the required stock for the subsequent finishing process while still maintaining the required scallop depths.

The new Gleason P90iC Hobbing Machine also integrates chamfering/ deburring, but is configured differently to accommodate mainly shaft-type parts – and to eliminate the burrs typically formed by chamfer rolling in the tooth flanks in a subsequent, second cut. As a result, the processing of workpieces on the P90iC is sequential – but all performed in a single setup: load; first hob cut including removing the rough burr; chamfer rolling and deburring; second hob cut to remove the burr on the tooth flank and to generate the required scallop depth; unload and repeat. Note that cutting parameters are chosen for this two-cut process that



Chamfering/Deburring



Chamfer contour milling employs a fly cutting process using milling cutters with indexable carbide inserts featuring two or four blades. A few insert sets can cover a wide range of modules making the fly cutting process extremely flexible while at the same time relatively inexpensive.

keep total hobbing time close to that of the single-cut process.

It's important to also note that, in conjunction with these machines, a wide array of chamfer rolling and deburring tools are available to meet the particular requirements of every process, as well as the customer's particular application. Solutions range from simple chamfer tools to fulfill basic requirements for comma-type or parallel chamfers, root chamfers and acute and/or obtuse flank chamfers, to highly sophisticated chamfering tools with edge zone burnishing options for producing very tight-tolerance chamfers and being able to adjust to modified compensation for heat treat distortion downstream and to help optimize subsequent hard finishing operations.

Chamfer Contour Milling

For hobbing of larger cylindrical gears in small batches where flexible lot production is desirable, a new continuous 'fly cutting' process offers significant advantages for improving chamfering flexibility as well as reducing machine and tooling costs

as compared to chamfering on a dedicated, stand-alone machine. The continuous fly cutting process generates a chamfer along the gear edge contour by synchronizing fly cutter and workpiece rotation such that the fly cutter – generally a star-shaped body with 2-4 standard, replaceable indexable carbide inserts – contour mills the chamfer with the desired characteristics. The process enables just a relatively few different standard insert blade sets to accommodate a wide range of gear sizes, geometries and chamfer requirements.

While fly cutting has been long employed on bevel gear cutting machines, it has just been adapted for the first time as a viable chamfering process for cylindrical gears on Gleason's new Genesis® 400HCD Hobbing Machine, designed for workpieces up to 400 mm outside diameter and module 8 mm. With the addition of a CNC chamfering/deburring module, positioned at 90 degrees to the main hobbing work area, the 400HCD now has the capability to apply contour milling for chamfering/deburring in parallel with the hobbing operation, thus eliminating the cycle times and cost per piece added when chamfering/deburring

conventionally. A four-station ring loader transfers workpieces between the machine's central worktable and the chamfering/deburring station, which is equipped with the aforementioned fly cutter. Even with the added chamfering/deburring module the machine's overall footprint is surprisingly compact.

In summary

Gear manufacturers globally are recognizing that chamfering and deburring simply aren't processes that can be overlooked – or undervalued – any more. Fortunately, the application of these auxiliary processes has never been easier, faster or more economical, whether it be for small gears produced by the many thousand, or larger gears in lot sizes of just a few.



Gottfried Klein
Director of Product Management
Hobbing, Chamfering and Shaving
Gleason Corporation

Faster Production of Geared Shafts



100HiC Hobbing Machine with Integrated Chamfering/Deburring

The 100HiC with integrated chamfering/deburring unit and Gleason automation speeds production of geared shafts and disc-type workpieces up to 100 mm in diameter and module 4 mm.

The 100HiC can cut gears and shafts but has been optimized for the production of shafts using a one- or two-cut process for finish hobbing or pre-hobbing for subsequent hard finishing operations.

Features include:

- Direct-driven hob head options offer the right solution for different applications.
- Optimized solution for shaft-type workpieces.

- NC chamfering/deburring process for consistent quality results.
- New operator software reflecting modern user flows.
- Gleason rotary chamfering/deburring tools for precise chamfers according to customer's specifications.
- Horizontal axis configuration allows for efficient chip removal, especially for dry machining.
- Various loader options for short loading and unloading times.
- Cutting and chamfering with minimum floor space requirements, starting at just 6 m² (64.5 sq. ft.).



See You at These Events

2017

EMO	Hanover, Germany	September 18-23
IMT	Plovdiv, Bulgaria	September 25-30
MSV	Brno, Czech Republic	October 9-13
Gear Expo	Columbus, OH USA	October 24-26
Gleason Japan Seminar	Tokyo, Japan	November 10
Metalex Thailand	Bangkok, Thailand	November 22-25

2018

IPTEx	Mumbai, India	February 22-24
GrindTec	Augsburg, Germany	March 14-17
SIMTOS	Goyang, South Korea	April 13-17
Control	Stuttgart, Germany	April 24-27
Metalloobrabotka	Moscow, Russia	May 14-18
Mach-Tool	Poznan, Poland	June 5-8
IMTS	Chicago, Illinois USA	September 10-15
AMB	Stuttgart, Germany	September 18-22
MSV	Brno, Czech Republic	October 1-5
Maktek	Istanbul, Turkey	October 2-7
JIMTOF	Tokyo, Japan	November 1-6
Metalex	Bangkok, Thailand	November 22-25



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Gleason

Gleason Corporation
Tel. +1 585 473 1000
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