



Speed in Top Form

HSC Cutting with the HEIDENHAIN iTNC 530

GEMÜ in Ingelfingen, Germany, uses the expertise of its toolmaking people for the manufacturing of innovative valve, measuring and controlling systems. Not only is the highest possible surface quality important, but the toolmaking department has long seen itself as the "tool production department" for GEMÜ's own needs and as a partner for outside customers. It's all about the fastest possible door-to-door times and the highest possible productivity. Fast 5-axis simultaneous machining with an Exeron HSC 600 milling machine, controlled by a HEIDENHAIN iTNC 530, plays an important role here.

For some time now, direct High Speed Cutting (HSC) has been gaining in importance compared with classical die-sinking EDM. Precise control of the enormous acceleration and deceleration processes along a programmed path is a



prerequisite for fast, accurate contouring. The path control of the CNC control has a decisive influence on the optimization of machining times under given requirements for accuracy and surface definition.

Careful comparisons result in an optimal solution

Ralf Herrmann, manager of mold design and tool production, searched the market intensively to find a solution that meets stringent requirements for surface definition while at the same time ensuring high productivity. After all, in 2008 he had to manage the production of 73 new tools and numerous tool changes. Ralf Herrmann says, "With the combination of the Exeron HSC 600 and the HEIDENHAIN iTNC 530 we observed the shortest noncutting time in comparison with other systems. The machine has been producing for about six months and we're getting ever better at exploiting the

Did You Know...

...that HEIDENHAIN linear scales are an integral part of a unique micro-machine operation borne of two University of Illinois researchers? While they introduced the concept of "small machines for small parts" at the IMTS Emerging Technologies pavilion in 2004, researchers Andy Phillip and Andrew Honegger took that idea and incorporated a company in 2005 built on that premise and called it **Microlution Inc.** (www.microlution-inc.com), Chicago, IL. This company has shown steady growth every year, even during difficult economic times.

"Microlution fills a special niche offering the ability to make very small parts, very fast and accurately, at a fraction of the cost of a large CNC," said Phillip, Microlution president. "The use of small machines for small parts offers users a productivity increase typically ranging anywhere from 20% to 3 times. We are currently seeing strong interest in these compact micro-machines by those in the biomedical field, job shops and researchers." Phillip explained that common parts currently made in their small machine tools are orthopedic implant parts such as bone plates and spine components, and small surgical devices and parts.

With these small parts comes the need for very high accuracy and very tight tolerances. "Our original prototype micro-machines had been using position feedback scales with a 20 micron grating period but as we evolved and incorporated, it became clear that we needed smaller grating and better resolution so we looked to HEIDENHAIN," said Phillip. "And to be honest, people recognize HEIDENHAIN



Microlution 363

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scales as high quality and reliable, so it helped us as a new company to provide this positive touchstone to our potential customers as we shared information about our unique product."

At this time, Microlution offers two core products: the Microlution 363 – a 3-axis micro-milling machine offering a 2 ½ inch working envelope (2 foot square machine footprint) and the Microlution 5100 – a 5-axis micro-milling machine offering a 4 inch working envelope (there is a 3-axis version of this with an 8 inch envelope). These machines offer 2 micron accuracies and sub-micron repeatability. They are built using high rpm spindles, linear motors throughout and are based on granite substructures."

Both HEIDENHAIN sealed and exposed linear scales are in use at Microlution. Sealed linear encoders from HEIDENHAIN are protected from dust, chips and splash fluids and are ideal for operation on machine tools. The beneficial dynamic behavior of these linear encoders, their highly reliable traversing speed, and their acceleration in the direction of measurement predestine them for use on highly dynamic conventional axes as well as on direct drives. HEIDENHAIN's exposed linear encoders operate with no mechanical contact between the scanning head and the scale or scale tape. Typical areas of application for these encoders include measuring machines, comparators and other precision devices in

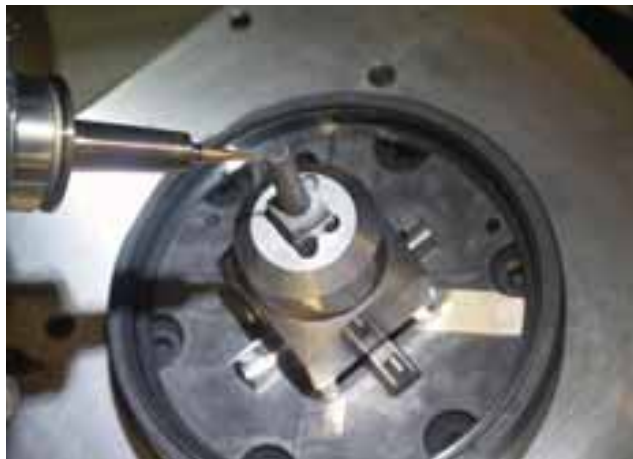
linear metrology, as well as within production and measuring equipment.

The performance of the HEIDENHAIN products is great," said Phillip. "Their specs are always conservative so our testing always goes smoothly. And even though I know we're not their biggest customer, we feel like they treat us as one."

For more information, please go to www.heidenhain.com

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opportunities of 5-axis technology. There were other controls in the competition, but our highly trained specialists need only a short time to familiarize themselves with operating the HSC 600 thanks to their previous experience with the iTNC." Walter Oechsle, foreman in the GEMÜ tool production department added, "My people were able to work with the new equipment



Glance into the machine room: precise HSC milling

after a two day course at Exeron. They needed almost no new training on the controls. After all, the CNC machines for tool production are already equipped with HEIDENHAIN controls. Only some special machine functions such as the laser calibration were new for them." "One old advantage of the HEIDENHAIN control," said Oechsle, "becomes apparent in 5-axis machining: I can't have everything programmed offline for

the toolmaking department. On the Exeron HSC 600, too, we often use the convenient shop-floor programming of the iTNC."

One of the GEMÜ tool production department's responsibilities is still the manufacture of electrodes for use in EDM machines. And many of the electrodes take up to 30 minutes of machining time, of which tool changing represents a considerable share. Productivity will be increased even further by a pallet system that will be installed in the upcoming months. Ralf Herrmann is also thinking about integrating HSC milling machines in the production process in order to manufacture serial parts and save on polishing. After all, the GEMÜ tool production department is both a test center for future technologies and it prepares for serial production. With the Exeron 600 HSC series, controlled by the HEIDENHAIN iTNC 530, GEMÜ has a good horse in its high-tech stall.

Safe from collision and easy to recalibrate

Collision monitoring has become an important feature at the feed rates involved. GEMÜ has found the function to be very reliable—even in manual operation!

Then there's the gain in accuracy thanks to **KinematicsOpt**. Rather than editing the NC program, this feature of the iTNC 530 adapts the kinematic model saved in the machine. Changes in the kinematics are measured and, if desired, automatically compensated with the aid of a high-accuracy HEIDENHAIN touch probe and the absolutely precise HEIDENHAIN calibration sphere. With this compensation information for recalibration, which takes only a few minutes, the machine can move the tool more accurately along the programmed contour. The error

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of the calibration sphere center is logged for all rotary axes, and statistical evaluations inform the user whether the required accuracy can be maintained through recalibration or whether an entirely new calibration is necessary. To really understand how up to five axis move simultaneously, to always know which zero point has to be active for which side, requires a great deal of skill and demands your complete attention. This is where KinematicsOpt helps: the user only needs to place the calibration sphere correctly on the machine table to be able to machine precisely in the long term or to reduce running-in periods.

It depends on the control strategy

The high feed rates in HSC machining inevitably require higher axis accelerations on curved workpiece contours. Each machining task must be performed so that highly dynamic movements do not cause disturbance from machine vibration and reduce the quality of workpiece surfaces. Motion control for 5-axis machining places especially high demands on the control. At the same time, the machining time has to be minimized and the surface definition optimized while fulfilling given accuracy requirements. To keep the production times in an acceptable range, freeform surfaces are frequently milled with path directions reversed between passes. Meanwhile, the control must generate reproducible tool paths when approaching contour elements from opposing directions. The deviations between adjacent milling paths must remain significantly smaller than the defined path tolerances.



This injection molding die is used to manufacture a valve body of PFA (Teflon).

NC programs for free-form surfaces are usually created with a CAM system and consist of simple line segments. HEIDENHAIN controls automatically smooth the block transitions while the tool moves continuously on the workpiece surface. This automatic



smoothing is controlled by an internal function that monitors the contour deviations. This function (Cycle 32) enables the user to define the permissible contour deviation. Without smoothing of the nominal path data, the axes of the machine would have to accelerate abruptly at the transition points. The resulting jerk would excite intensified oscillations of the machine. Contouring deviations would inevitably occur that, depending on the change of curvature and path velocity, would reach dimensions that cannot be tolerated in micrometerprecise machine tools. The path control of the iTNC 530 smoothes the jerk and complies with the given contour tolerance even with strong changes in contouring speed.

GEMÜ Gebr. Müller Apparatebau GmbH & Co. KG

From the very beginning, more economy, consistent, reliable product quality at affordable prices and more benefit for the customer were the motives for industrial valve manufacture at GEMÜ. The invention of the world's first directly controlled electromagnetically actuated seat valve made of plastic (PVC) in 1963 enabled design engineers to take their first economic steps toward automation in the field of galvanic systems. In his parents' garage and kitchen in Ingelfingen, Germany, Fritz Müller manufactured the first of the plastic process valves he had invented. This was followed in 1977 by the development of the plastic variable-area flow meters in the GEMÜ 800 and GEMÜ 850 series. One important milestone in the company's development was the inauguration of the new GEMÜ DOME innovation center in January 2009. Today, GEMÜ enjoys great respect as an innovative, owner-managed company with over 400,000 product variants and 12 subsidiaries worldwide.

www.gemue.de

New Absolute Angle Encoders from HEIDENHAIN Offer Many Advantages

For years, HEIDENHAIN Corporation has set the standard for technological measurement of angles through its offering of angle encoders with integral bearing and hollow shaft. These angle encoders provide reliable position and speed control through use on rotational axes such as on rotary tables, tilting axes and direct drives, and are often the encoders of choice when angle measurement in accuracy of a few angular seconds is required. Now, HEIDENHAIN introduces a new phase of these absolute angle encoders offering numerous advantages for today's machine tools.

Called the RCN 2000, RCN 5000 and RCN 8000 Series, these new angle encoders from HEIDENHAIN are characterized by their simple mounting and high accuracy. Main new benefits include greater mounting tolerances, optimized new scanning, and evaluation electronics with diagnostic functions, plug-in cables with quick disconnect at the encoder, and a variety of hollow shaft diameters.

The greater mounting tolerances now possible of these angle encoders are due to the better axial and radial deflection behavior, as well as the torsional rigidity, of the newly developed stator couplings. Together with a new sealing design on the encoders, relatively larger mounting tolerances are now

possible without restricting the operational functions and accuracy.

Also thanks to the use of an innovative single-field scanning principle with a special optical filtering, this series of HEIDENHAIN angle encoders produces scanning signals of very high quality. The resulting position errors within one signal period are typically smaller by a factor of three to four compared to previous angle encoders. The scanning principle also contributes to a significant reduction in sensitivity to contamination. And with the new scanning and evaluation electronics, it has become possible to dramatically reduce the influence of the rotational speed on the generation of position values. This ensures that, even at high speeds, the scanning signals have high signal quality and continue to interpolate well.

And in contrast to previous units, these new HEIDENHAIN angle encoders feature a flange socket to which an adapter cable is attached. In instances where a normal screw-on connection is not practical, HEIDENHAIN offers a special quick disconnect system (push-pull solution) where the adapter cable is simply snapped on and off.

For more information click catalog <http://www.heidenhain.com> or contact your HEIDENHAIN sales representative.



HEIDENHAIN's new Portable Interface Box Eliminates Need for PC Cards



The new EIB 741 now available from HEIDENHAIN Corporation is an external interface box that removes the requirement of a PC interface card that is usually necessary when connecting measurement apparatus to an industrial PC or laptop.

The EIB 741 is network capable and ideal for inspection stations and multipoint inspection apparatuses as well as for mobile data acquisition, such as in machine inspection and calibration. A maximum of four HEIDENHAIN encoders, either with sinusoidal incremental signals (1Vpp) or with EnDat interfaces (EnDat 2.1 and EnDat 2.2), can be connected to the EIB 741.

This external interface box subdivides the periods of the incremental signals up to 4096-fold for measured-value generation. The integrated measured-value memory enables the EIB 741 to save up to 250,000 measured values per axis. Internal or external triggers can be used for axis-specific

Portable Interface Box *continued from Page 4*

storage of the measured values.

A standard Ethernet interface using TCP/IP or UDP communication is standard for data output. This permits the direct connection to the PC or laptop. The type of measured-value transfer can be selected through the operating mode (transfer of individual values, block transfer, or transfer upon software request).

Driver software for Windows, Linux and LabVIEW is included in the items supplied in order to process the measured values on

the PC. The driver software facilitates programming as well as includes programming examples demonstrating the performance range of the EIB 741.

Thanks to its compact dimensions, two EIB 741 interface boxes fit next to each other within a standard 19-inch housing, occupying one height unit. Multiple boxes can also be daisy-chained in other configurations.

For more information visit <http://www.heidenhain.com>.

Looking Forward to 2011

By Chris Weber, National Sales Manager, Machine Tool Division



Chris Weber
*National Sales Manager
Machine Tool Division*

As 2010 winds down, we note a tumultuous past 18 months. The unprecedented decline in the general economy as seen in 2009 has been followed by a much stronger than anticipated recovery in the US manufacturing sector. Led primarily by the electronics industry, machine tool has also seen substantial increases.

most attendees expressing strong buying interest. While overall attendance may not have been as hoped, those who did attend, were there to buy. Many exhibitors reported strong sales from the show floor and post show as well.

In anticipation of sustained growth, HEIDENHAIN has added additional capacity in the form of product managers and product specialists. In the machine tool group, I am happy to inform that we have added two new bodies.

Danny Vitullo is our product specialist for all CNC applications. As a former service technician with our Acu-Rite / ANILAM organization based in Southern California, Danny brings a wealth of control and general machine tool knowledge to our group. Having relocated to our headquarters in Schaumburg, Danny is available to address all facets of control support from application to quotations and integration assistance.

Nathan Mathiot joins us in the capacity of product specialist for measuring systems and digital readouts. Having graduated from the Milwaukee School of Engineering with a degree in Mechanical Engineering and having undergone extensive training at HEIDENHAIN with respect to products and applications, Nathan stands poised to assist with your needs within his areas of expertise.

I invite you to contact these two specialists the next time you have questions or applications.



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2011 holds many challenges and opportunities for those of us in the machine tool world. At HEIDENHAIN, we are ready to launch a number of new products that will reinforce our position as the market leader in measurement and control.

I would like to thank all of you for your continued patronage and loyalty to the brands in the HEIDENHAIN family, and wish you all a safe and happy holiday season.

HEIDENHAIN SUPPORTS AMERICAN PRECISION MUSEUM

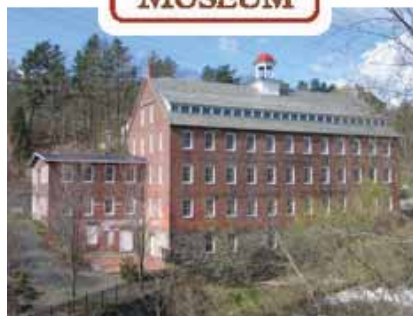
Showcasing the largest collection of historically significant machine tools in the nation, the American Precision Museum (APM) in Windsor, VT now adds HEIDENHAIN Corporation to its long list of members.

Located in the 1846 Robbins & Lawrence Armory where the concept of interchangeable parts was brought to practical perfection, APM gives visitors a look into the history of early machines and their impact on society. The advent of highly precise, exact parts started here with guns and rifles for war, with the concept later making its way to mass produced machines.

"This museum preserves the heritage of the mechanical arts and we understand its significance to all of us even today," said HEIDENHAIN Holding company president Rick Korte. "HEIDENHAIN also has a long, strong past in precision measurement, and we know the importance of maintaining history. We are proud to be a member."

Open from Memorial weekend through October, visitors to the APM will see collections of not only significant machine tools, but also early firearms, measuring devices, sewing machines, typewriters and other unique objects. Museum information is available at www.americanprecision.org

"The richness of history and relevance to our more elaborate lifestyles of today is completely underscored by what took place here," explained Hub Yonkers, APM board trustee since



2002. "The concept of precision manufacturing provides the foundation for modern industry around the world – from mass communication, rapid transportation, modern standard of sanitation and medical care, as well as the basis of abundant food and clothing, and we are pleased to be able to preserve its evolution here at the museum."

Besides supporting an important cause, members receive a subscription to the APM's "Tools & Technology" newsletter, invitations to special events, and free museum admission and discounts on site.

A Machine Tool Hall of Fame is part of the museum's website and began as a joint project with the AMT (Association for Manufacturing Technology) in 1993. This Hall of Fame includes approximately 50

elected members who have made significant contributions to the industry (from 1765 to present).

"It is an extraordinary thing that this factory building is still standing," said Yonkers. "It is so rare to have an event focal point of real historic significance still in existence, and we are thrilled to have preserved it to serve as the home of the museum to house our collection of historic machine tools." Over 150 years old, the well-built gun armory has undergone some significant renovations over the past several years, but more restoration work is necessary.

To view an 8 ½-minute video about the American Precision Museum, please go to: http://www.americanprecision.org/general/video/a_video_introduction_to_the_american_precision_museum/

CONTACT INFORMATION

For more information about HEIDENHAIN and any of the products or services mentioned here, please feel free to contact us.