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Megatrends as an opportunity for mechanical engineering

The machine tool market is booming and is increasingly subject to changing requirements relating to technologies, materials, processes and use of resources. These changes are demonstrated by the strong growth in newly industrializing countries such as China and India and shifting requirements in traditional high-technology countries. The so-called megatrends are driving these changes. These megatrends include increasing globalization, urbanization and rapid growth in population, demographic transformation and climate change. We are faced with different challenges as a result. The markets of the newly industrialized nations demand specific machines that are robust and easy-to-operate in order to be able to manufacture products quickly in large quantities. High-technology markets such as Europe, which have embraced innovative technologies and optimized processes, demand solutions that enable high productivity and precision as well as maximum flexibility.

At EMO 2011, we will demonstrate you how you can turn these megatrends into opportunities. Siemens offers efficient production technologies and innovative CNC solutions — for example, for complete machining on multi-tasking machines. We provide not only products and systems but also complete solutions beyond the machine lifecycle, because resource-saving production and cost-optimized use of energy are becoming increasingly important. We also offer efficient processes thanks to consistent IT and product lifecycle management (PLM) solutions.

See our total solutions for yourselves in this issue of motion world — and at EMO 2011 in Hannover!

I look forward to your visit.
Siemens is presenting its innovations at EMO and offering flexible solutions to meet the current and future requirements of the metal-working industry under the slogan “Productivity in Motion.” We spoke to the head of the Machine Tools (MT) Business Segment, Joachim Zoll, about the changing requirements in the industry.

Mr. Zoll, what are you offering your customers at EMO in the way of new solutions and technologies?

Joachim Zoll: In the metal-working industry — as in many other branches of industry — the goal is to achieve maximum productivity as efficiently as possible with the available resources. With future-oriented technologies and products, we offer our customers high productivity, competitive advantage, and safety. We focus especially on sustainable production solutions for future growth markets such as medical part manufacturing, power generation in the field of renewable energy, and the consumer industry. But established markets, such as the automotive and aircraft industries, will also change and face new requirements — focusing on electric vehicles, new technologies for lightweight construction, and modern materials such as composites, for example, as it is becoming increasingly important to optimize the use of resources. This is just as true for an energy-efficient factory as it is for machines, production processes, and products.

What are the special demands on mechanical engineering today?

Joachim Zoll: The future of mechanical engineering will be greatly influenced by megatrends such as globalization, urbanization, demographic transformation and climate change. Increasing globalization is both a challenge and an opportunity for mechanical engineering. In the machine tool industry, there is a trend of a regional shift toward markets in the newly industrializing countries. While the established markets are tending to stagnate, considerable growth is noticeable in emerging markets. In the BRIC states — Brazil, Russia, India, and China — experts are expecting economic growth to be double that of the established OECD states in the years to come. Therefore, the challenge is: how can European mechanical engineering firms assume a leading position in the markets of the future for the long-term and thus survive global competition?

And how is Siemens helping companies win these regional markets?

Joachim Zoll: The rapidly growing markets in newly-industrialized nations demand specific products that are adapted to the respective technological demands and complexity of the production tasks. The machines need to be robust, but also easy to operate and maintain. We meet the demand for adapted products for use in standardized machines that are able to withstand the stresses of mass production with so-called SMART products. SMART stands for “simple, maintenance-free, affordable, robust, and timely to market” — factors that are important for cost-efficient machine tools, especially in newly-industrialized nations.
What role does regional expertise play?

Joachim Zoll: A very important one. We rely on regionally-available knowledge and added value in the planning, development and manufacture of the products. Specific examples of this are the Sinumerik 828D Basic T and Basic M compact CNCs, which have already celebrated success at the IMTEX fair in India and the CIMT fair in China. This addition to the Sinumerik 828D family, with technology-specific introductory models for standardized lathes and mills, was tailor-made for specific requirements using the expertise of regional Siemens colleagues. The Sinamics S120 Combi – which is perfectly adapted to production conditions in newly-industrialized nations, with its compact dimensions and its robustness with regard to temperature fluctuations, dirt and humidity — was also developed in close cooperation between German and regional colleagues.

What effect do the other megatrends have?

Joachim Zoll: Let’s consider demographic transformation first. The population is getting older and older on average, so the need for good, affordable medical services is growing. There is an increasing demand for implants and medical equipment, which is already being reflected in growth in the medical technology industry. High precision is very important in the production of implants, for example. Operation times can also be reduced when the implant is adapted to the bone rather than the other way around. Continuous traceability must also be ensured due to strict regulation.

As far as the urbanization trend is concerned, this change is characterized by massive concentration and growth in the urban population. The demand for mass-produced articles such as consumer goods and electrical appliances increases as a result.

» We not only support the entire machine lifecycle from machine planning to optimized machine operation with services such as Mechatronic Support, but we also enable even more efficient processes and lower lifecycle costs throughout the entire production process with a complete CAD/CAM/CNC process chain. «

Joachim Zoll, Head of the Machine Tools (MT) Business Segment
Because these goods reach the market in increasingly faster innovation cycles, maximum productivity and rapid product design are required in the manufacture of these products. Another trend affecting much more than the machine tool market is climate change. The need to save resources and ensure efficient, cost-optimized use of energy has a massive influence on machine tools and especially on automation solutions. We provide support here with energy-efficient Sinamics drives and motors and services such as Mechatronic Support, which can reduce moved masses by simulation and thus also the energy consumption of the machine. In the future, we will offer our energy-efficiency solutions under one name: Sinumerik Ctrl-Energy. So you can see that energy-optimized processes and efficient product chains are in demand at every level of the company.

Siemens is ideally equipped for this task, isn’t it?

Joachim Zoll: We do indeed see ourselves as ideally equipped as a technology and innovation leader. Companies that face the challenges presented by the megatrends at an early stage will ultimately have more success in the growing markets. To achieve this success, the metal-working industry needs effective, productivity-increasing technologies and CNC solutions. We have done our homework and prepared our product portfolio for the future in terms of increased productivity, user-friendliness, and energy efficiency. A beginner’s model Sinumerik 840D sl Basic is now available with our proven, open and flexible premium CNC platform Sinumerik 840D sl. Our motors and spindles have also been developed further with the goal of increasing performance and energy efficiency. A development that we can observe in the industry is the increasing use of multi-tasking machines that combine several technologies such as milling and turning. The advantages of such machines are obvious: the workpiece can be machined faster and more accurately in one setting. The innovations of the Sinumerik 840D sl therefore include integrated functionality for complete machining with Sinumerik Operate. Optimization of the Sinumerik MDynamics technology package enables shorter machining time with higher surface quality.

You mentioned climate change and the necessity for efficient processes and production changes. Could you explain that?

Joachim Zoll: Siemens sees itself quite generally as a partner for the entire machine lifecycle. We not only support the entire lifecycle from machine planning to optimized machine operation with services such as Mechatronic Support, but we also enable even more efficient processes and lower lifecycle costs throughout the entire production process.
with a complete CAD/CAM/CNC process chain. However, efficiency today is required above all with respect to the consumption of resources. Here we offer a range of solutions with Sinumerik Ctrl-Energy, which bundles the company’s energy-efficiency expertise for machine tools — from a comprehensive portfolio of drives and motors, CNCs and drive functions, and all PC software solutions to our Sinumerik Manufacturing Excellence services.

Another essential prerequisite for lean, efficient production is the integration of machine tools into existing company processes. With integration into the company’s IT system, fast processes can be implemented that enable short product introduction times in mechanical engineering and industry. To facilitate this integration, we have developed the Sinumerik Integrate process suite, which enables machine tools to be integrated into extensive communication, engineering, and production processes.

You see, we have answers to the challenges of the future and will be happy to show you our solutions at EMO 2011 in Hannover.

Mr. Zoll, thank you for speaking with us.

Product highlights at EMO 2011

- Sinumerik 828D Basic T and M for standardized lathes and mills
- Sinumerik 840D sl — new performance variants
- Sinamics S120 Combi compact drive for simple lathes and mills
- Sinumerik MDynamics with improved five-axis functionality
- Solutions for multi-tasking processing with Sinumerik 840D sl
- Improved user-friendliness with Sinumerik Operate
- Sinumerik OP 019 Operator Panel with new operating technology and high-quality design
- Sinumerik Ctrl-Energy for energy-efficient machine tools
- Sinumerik Integrate for the integration of the CNC into communication, engineering and production processes
- Further development of the comprehensive Siemens motor portfolio

Siemens at EMO 2011

Also visit us online!

Extensive information on our presentation at EMO 2011 can be found on the Internet. Visit our website at:

www.siemens.com/emo

Information about EMO is also readily available via your smartphone — simply scan the QR code on the left.
In addition to the mechanical and electrical design, the control system is especially important in getting maximum productivity from high-performance machine tools. Wage production companies and other single-part and small-series production companies must have the right equipment for optimum operation of the machine and CNC. As a new high-end operator panel that is exclusively combinable with Sinumerik 840D sl and the Sinumerik Operate user interface, Siemens is presenting the OP 019 operator panel with PCU 50.5 at EMO 2011. Designed as a high-performance main operator panel, it is primarily suitable for applications as a programming station on high-end milling, turning, grinding and laser machines. As required by the customers, it has the same 483 mm (19-inch) maximum panel width as the OP 015 version. The panel can, therefore, be changed at any time on the shopfloor without problem.

Clearly arranged and user-friendly
To achieve maximum possible clarity without changing the width of the panel, Siemens engineers have extended the OP 019 upward to 400 mm (15.75-inches) and minimized the non-functional outer frame all around. With this, they have succeeded in equipping the control panel with an enormous glass front, which lends a brilliant appearance to the 19-inch industrial display with a resolution of 1280 × 1024 pixels. Previously, a maximum of only

An Elegant Addition to High-End CNCs

User-friendly, efficient, robust, modular and well designed — that sums up the new Sinumerik OP 019 operator panel. It received the iF Product Design Award 2011 for its functional design.
five-axes were possible to display, but now up to 13 axes can be displayed simultaneously in the basic machine image. In addition, up to four channels can be shown on the large display.

The OP 019 is operated by rows of touchkeys on the left, right and bottom edges of the screen, which trigger extremely fast and reliably thanks to the capacitive sensor technology. Unlike the previous resistive technology based upon resistance measurement that was common in the industry, no plastic foil needs to be fitted to the OP 019, providing robust advantages. A slight touch with the finger suffices to trigger the key, and the function keys can be activated without any problems, even when wearing gloves. To prevent operating errors, the trigger parameters were optimized to avoid simultaneous operation of several keys. The wide LEDs, which are fitted above the sensor keys, are also a convenient detail. All test users appreciate recognizing which functions are activated at a glance. The LEDs are always easily visible, even when operating with gloves.

**Equipped for rugged shopfloor use**

Thanks to the single glass plate, the entire front of the control panel has only one surrounding gap that needs to be sealed. This provides even better protection than IP65, which is normal for Siemens operator panels. With IP66, the degree of protection against liquids is particularly high. The OP 019 is unbeatable in terms of robustness and is ideally equipped for rugged shopfloor conditions.

The OP 019 can be used with all the accessories that users are familiar with from the operator units OP 010, OP 012, and OP 015A. A CNC full keyboard, a machine control panel or a machine push-button panel can be connected to the unchanged connection geometry. It makes no difference whether you choose operating components with mechanical keys or with a membrane.

**Award for Good Design**

In addition to many functional advantages, the attractive design of the OP 019 is particularly striking. A successful design can be an important value-adding factor because attractive products are easier to market. Many observers associate innovation and quality with an attractive appearance. Operators simply enjoy using good-looking equipment. Experience shows that operators handle attractive products more carefully and make sure that they stay in good shape.

The OP 019 won the iF Product Design Award 2011. Founded in 1953, this prize is awarded in 16 categories today and is considered the most important mark of innovative product design. In 2011, jurors were presented with 1,121 products from 43 countries, and 993 received this renowned seal of quality. The critical eyes of the jury assessed design quality, workmanship, choice of material, degree of innovation, environmental friendliness, functionality, ergonomics, use visualization, safety, brand value and branding, and universal design. Siemens received the coveted award in the category of Industry and Skilled rades. The jury appraised the strictly minimized design with functional technology. Siemens is particularly pleased with this success because many well-known manufacturers from the consumer goods field submitted their products and are among the award winners this year.
For smooth and efficient production today, an important pre-requisite is consideration of machine and production data. Used as a basis for decision, analysis and calculation, these data affect every area of a company, from development and procurement to production and sales. Only a complete overview of the company allows the transparency that is necessary to recognize and eliminate weak points and to develop a continuous improvement process.

**All IT products bundled in one suite**

Siemens offers an extensive product landscape for engineering and process support for Sinumerik.
which can now be accommodated under one roof
with Sinumerik Integrate. The innovative engineer-
ing and process suite based upon Sinumerik Operate
groups together all the integrative and IT-related
topics as a consistent IT base; and it offers easy,
fast and reliable integration of machine tools into
the company processes. The integration of the pro-
duction processes also links the people working in
the company — production managers, plant oper-
ators, programmers in work preparation, mainte-
nance staff and machine designers — by an IT
system and integrates them into the whole sys-
tem by the defined processes.

Benefits for machine tool builders
and owners
With Sinumerik Integrate, the machine manu-
facturer can design machine tools to be even
more productive over the entire lifecycle and
commission them more effectively in an in-
novative PLM process. The benefits here include
various possibilities for machine-specific opti-
mization of Sinumerik in technology, program-
ning, and operation. Of course, the machine
operator can also make specific optimizations
to the programming and operation, thanks to the
openness of the Sinumerik CNC.

On the other hand, machine tool manufacturers
can also integrate their machines quickly, easily
and efficiently into comprehensive company
production and communication processes with
Sinumerik Integrate. Efficient local support can
be provided with Condition Monitoring, Remote
Access and other solutions.

Sinumerik Integrate also enables fast, simple
machine integration into a complex, existing com-
pany IT for the machine tool owners. They benefit
here from a higher productivity and availability
as well as lower production costs on the whole.
A closed CAD/CAM/CNC sequence minimizes the
effort for program creation and simulation and
for running in NC programs.

Six modules for integration
Sinumerik Integrate is based on six different modules

Create-it!: Solutions for creating and adapting
user interfaces in Sinumerik Operate, for pro-
gramming interfaces to the machine tools
and the server as well as creating own compile
cycles for the NC core.

Lock-it!: The know-how protection is an inte-
gral part of the Sinumerik Integrate software
suite. The extended protection of technological
knowledge against unauthorized access is
provided by a technical copy protection and
safe storage of know-how, for example, by
encrypted cycles.

Run-it!: Runtimes for executing individual screen
interfaces on the Sinumerik within the scope
of open architecture. The module enables the
execution of own compile cycles on the NC core
and the drives as well as of the virtual NCC.

Manage-it!: Organization and management
of NC programs and tools. It includes the well-
known solutions for the fields of tool, data, and
program management for fast, company-wide
availability of production information.

Access-it!: Forms all the interface functions
associated with Sinumerik and allows remote
access for machine diagnostics. This increases
machine availability by fast online presence and
thus enables costs savings in service.

Analyze-it!: Provides all the functions for
condition-based maintenance and parameter-based
analysis. This prolongs the life of machines by
condition-oriented maintenance and reduces
failures and downtimes.
SINUMERIK Ctrl-Energy

Future Solutions for Energy Efficiency

An increasing number of users in emerging, as well as established industrial nations are demanding energy-efficient machine tools. Thanks to its many years of experience, Siemens has a leading position in this field.

Energy efficiency is playing an increasingly important role in production — partly due to rising energy and production costs, but also due to regulations aimed at reducing energy consumption. Users, as well as manufacturers, are therefore paying greater attention to energy efficiency. Siemens sees itself as a pioneer in matters of sustainability and energy efficiency and also aims to be a leader in the development of energy-efficient systems for machine tools.

Sophisticated range of solutions for maximum energy efficiency

Sinumerik Ctrl-Energy offers the customer not a single solution, but a wide range of solutions for energy-efficient operation of machine tools consisting of drive and motor components, CNC and drive functions, PC software solutions and Sinumerik Manufacturing Excellence services. Sinumerik Ctrl-Energy is based upon the complete portfolio of CNCs, Sinamics drives and motors and therefore covers all types of machines — from standard machines to premium machining centers. Sinumerik Ctrl-Energy offers energy-efficient solutions for the entire machine lifecycle, from design through the utilization phase to partial or complete refurbishment. Sinumerik Ctrl-Energy offers both the machine builder and the machine user a broad basis for efficient cost management.

Sinumerik Ctrl-Energy also offers an extra benefit: with the Ctrl-E Analysis and Ctrl-E Profiles functions, which are activated by the easily remembered key combination Ctrl + E, users can very quickly evaluate energy consumption — and control energy consumption during standstills — from the operating panels of the Sinumerik controllers.

info contact

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andreas.groezynger@siemens.com

The highlights of Sinumerik Ctrl-Energy at a glance

- Sinamics S120 drive components with efficiency of up to 99 percent
- Intelligent Active Line infeed/return modules for full compensation of the reactive power of the machine
- Automatic reduction of the magnetization flow in partial-load operation of asynchronous spindle motors
- Synchronous and asynchronous motors for feeders and spindles with efficiency of up to 94 percent
- Standard asynchronous motors with 97 percent efficiency and Sinamics G120 frequency converters for energy-saving operation of ancillary units
- Control cabinets from Siemens designed for optimum energy consumption
- Ctrl-E Analysis and Ctrl-E Profiles for analysis and control of energy consumption
- Sizer configuration tool for CNC/drive/motor solutions with automatic optimization of energy consumption
- Mechatronic Support Expert Service for simulation and energy-efficiency optimization of new machines
Productivity Saves Energy

Index, a manufacturer of CNC turning machines and turn-mill centers, sustainably increases its productivity with Sinumerik products and services and thus achieves a high level of energy efficiency.

At the Index plant in Esslingen, Germany, energy and resource efficiency have always been the principle behind the development of CNC turning and complete processing machines. To improve both, the manufacturer has consistently relied on efficient automation technology from Siemens and on continuous reductions of processing times.

Productivity holds potential

“Achieving the shortest possible piece times increases not only productivity, but also energy efficiency,” says Eberhard Beck, head of control technology at Index, “because this automatically reduces the basic energy consumption of auxiliaries such as the hydraulics, cooling and lubrication for every produced workpiece.” This more-or-less fixed factor still often accounts for up to 50 percent of the installed nominal power of some machine tools. Resource savings of up to 25 percent are realistic in the long term with an optimum design of the overall system.

Efficient hardware

Siemens CNCs and drives have therefore been an integral part of Index machines for a long time. Currently, the company uses primarily Sinumerik 840D in combination with the latest modular Sinamics S120 drives. For decades, the machine manufacturer has been using feedback-capable converter technology to feed the regenerative energy back into the mains with every deceleration. More than 90 percent of the kinetic energy of the drives is recoverable in this way. Other optimizations of electrical energy consumption can be achieved, for example, by using optimum-efficiency synchronous motors as the main spindle and milling spindle drives.

» There is still energy savings potential in the further reduction of processing times, which always means an improvement in the energy costs per workpiece. «

Eberhard Beck, Head of Control Technology, Index-Werke GmbH & Co. KG

Higher energy savings can also be achieved by innovative new mechatronic concepts that allow a considerable reduction in the masses moved, for example. Here, Index relies on a new shearing/...
The “virtual machine” from Index enables programming and simulation outside the machine, among other things, and therefore saves energy.

The parallel kinematic concept that is controlled by a Sinumerik 840D. This kinematic concept, known as SingleSlide, achieves much greater rigidity and, at the same time, allows much higher acceleration values in comparison with the serial kinematics that are common today. These parameters increase both productivity and energy efficiency. Index also uses Siemens Mechatronic Support services from time-to-time in the development of its machine concepts. This allowed Index to validate and optimize the efficiency of the above-mentioned shearing concept for the latest SpeedLine C-machines even before the first prototype was built.

The manufacturing company also optimizes the energy consumption of its machines through the optimum adaptation and construction of the motors and drive components for the mechanical properties of its designs. But the use of innovative techniques outside the machine can also save a lot of energy and resources — especially with the “virtual machine” from Index, a one-to-one “copy” of the controller, operating system and machine that is based upon the Sinumerik 840D virtual NC kernel and is available for every Index machine. At an average of five to eight hours for the reprogramming of a relatively complex turned part, there are significant energy savings, especially on more efficient machines because no auxiliaries need to be kept ready for production. In addition, the virtual machine is also an ideal tool for both basic and advanced training because the real machines remain available for production. The entire process sequence — not only the workpiece quality, but also the processing time — can also be optimized more effectively than ever with the NX CAM system from Siemens PLM Software. This automatically increases energy efficiency.

Another Index solution involves on demand, pressure-controlled regulation of low and high coolant levels. For this, the machine manufacturer replaces the fixed-speed pump normally used elsewhere by a controlled low-power pump. This is also transferable to the hydraulic system. Further possibilities for optimizing resources are offered by reducing the heating...
of the machine and especially the control cabinet. Here, Index has relied consistently on water cooling with a central heat-reduction interface. The company in Esslingen often collaborates with the Siemens control cabinet specialists in the Solution Factory for Automation and Drives in Chemnitz, Germany, on the design of such systems.

And last but not least, the productivity of old machines can be increased again sustainably with Sinumerik 840D — for example, by simply installing a more efficient NCU. Old machines with older control systems can also easily be made fit for additional years of production by an extensive retrofit, that is, modernization of all the control and drive components. Siemens is able to advise and assist in both cases if required.

**Transferable to many machine tools**

Turning and complete processing machines from Index have always been a highly productive combination of innovative mechanical engineering and state-of-the-art control and drive technology.

What the company in Esslingen has long achieved in terms of energy efficiency with Siemens products and services is also an option for other machine tools with Sinumerik 840D controllers through the Sinumerik Ctrl-Energy comprehensive energy-efficiency package (see article on page 12).
Mill-turning with Sinumerik

A Cost-Saving Combination

Combined mill-turn centers with the latest Sinumerik 840D sl and the Sinumerik Operate user interface are the optimum solution for the production of complex parts such as turbines or compressor wheels in which turning tasks are required in addition to efficient five-axis milling.

Products and production processes are becoming increasingly complex in most industries. This trend inevitably demands the integration of different technologies into individual machining centers. While turning machines with milling functions have been on the market and in use for more than 15 years, milling machines with turning functions are still rather rare. But demand is growing, especially from companies that manufacture complex parts such as the turbines and compressor wheels that are used in the aerospace industry and energy production.

The way to a successful future

The technological emphasis in these industries is on milling, which represents an average of 80 to 90 percent of the work, although turning tasks, which require high degrees of roundness and precision, must also be regularly performed. For many users, this previously meant time-consuming resetting on separate turning machines, which had a negative effect on productivity and costs and also reduced accuracy. This disadvantage can be eliminated by combined mill-turn machines. After the introduction
of the first combined mill-turn machine 10 years ago, the technical breakthrough on the machine side came with the use of modern torque motors. These motors are able to accelerate rotary tables to sufficiently high speeds (up to 1,200 rpm) and thus provide the necessary torques. In addition, special spindle clamps were developed for milling spindles, which prevent the side torques produced during cutting with turning tools from damaging the high-speed spindle bearings.

In programGuide, the user can use contour cycles such as cutting-turning at any time. All mill-turn tools are displayed by icons in the Sinumerik Operate tool list.

Clear and simple operation with Sinumerik Operate

The simple operability and usability of the controller are important for practical implementation on the machines. Sinumerik 840D sl has proven itself in such applications. It can simulate all milling and turning tasks, thanks to the cross technology and open architecture of the Sinumerik NC kernel. With the HMI Advanced user interface, it has been possible already for many years to use the openness of the controller and display different machining technologies. The same also applies to the new Sinumerik Operate user interface, in which these possibilities were integrated uniformly into the system functionality. With the latest version of the control software, SW 2.7, Sinumerik Operate can simulate all common machine kinematics, with the user interface always remaining clear and uniform. This is very important, especially in hybrid machines, because the changeover from milling to turning makes great demands on the know-how and imagination of the machine operator.

Sinumerik Operate also simplifies the handling and programming of the machine. The user interface is identical in many respects to the Windows interface of a normal PC and contains practical functions such as copy and paste. The programGuide also provides all milling and turning cycles, including a cycle for the engagement of the turning or milling tool in any position. Another great advantage is that the programming and setup of milling and turning processes always has the same look and feel. The operator is also supported by graphical displays and animations in the setup.

Icons make the tool list even clearer

Sinumerik Operate offers a clearly structured tool list that the user can configure. Both milling and turning tools can be arranged on one page and even displayed with all cutting positions, with the lengths Z/X/Y, and with the respective machining direction. In addition, multi-tools that contain several single tools can be stored. Every tool is clearly identified by an icon as well, so that the operator can see all the relevant data at a glance and access them specifically.

If the machine operator has completed and set-up the combined cutting program, the cutting process can be run virtually in advance in the form of a new 3-D simulation. This allows all milling and turning processes to be viewed on the user unit. Errors are therefore detected quickly and can be eliminated without wasting valuable machine time and expensive material.
MCE Maschinen- und Apparatebau GmbH, Austria

Model Turbines from One Mold

Energy production specialist MCE uses a simultaneous five-axis mill-turn center with Sinumerik 840D sl for producing model running wheels in one setting and thereby reducing throughput time.

MCE Maschinen- und Apparatebau GmbH in Linz, Austria, produces various components for large gas, steam, and water turbines, as well as for wind power stations and other segments of energy production. But before the company receives any orders for these products, realistic models must prove their efficiency, underlines MCE CEO Gottfried Langthaler: “It is therefore very important for us to be able to manufacture the turbine models in high quality and, at the same time, productively with a short throughput time.”

In mid-2010, the running wheels were still being milled individually on a five-axis machining center and then bolted or welded together. The average throughput time was six weeks. Thanks to a few technical tricks and the Sinumerik-controlled GS 1000/5-FTD from Alzmetall, which has been used in model production since the end of 2010, the machining expert Langthaler was able to reduce throughput time by up to one-third — to about four weeks, depending on the product. As a qualified master of mechanical engineering and design, he already knew before purchasing the Alzmetall machine that it would be ideal for his model production if a Francis turbine could be produced from solid brass: “I was merely skeptical that a machining center could do that. After all, we have to achieve a high roughing cut and smooth with maximum precision and surface quality.” Initial tests with the GS 1000/5-FTD revealed that the technical conditions were right. Langthaler adds: “Alzmetall also flexibly adapted the machining center to our needs so that we can meet all the requirements regarding accuracy and surface quality — in one setting if necessary.”

User-friendly CNC for milling and turning jobs

Because this machine must also perform turning tasks, in addition to milling tasks, at MCE, this requirement is also in the specification and is met by the GS 1000/5-FTD. Buz Bozner, head of the Technology Center at Alzmetall, explains the technical basis: “We integrated torque motors in all round axes. We therefore achieve speeds of 300 rpm in the c-axis.” The mill-turn center offers an enormous machining space that not even standard lathes achieve. Parts with a diameter of up to 1,000 mm can therefore be machined. A highlight of the GS 1000/5-FTD is that it can be turned to any round axis position and level.

The energy professionals in model construction have been relying on Sinumerik controllers since the mid-1990s because, according to the mechanical
MCE Maschinen- und Apparatebau GmbH CEO
Gottfried Langthaler (right) and Buz Bozner, head of the Alzmetall Technology Center, agree:

»The efficiency of the Sinumerik 840D sl makes an important contribution to enabling simultaneous milling and turning in every position with the GS 1000/5-FTD.«

engineering boss Langthaler, these were always convincing, especially in complex five-axis machining: “The handling of Sinumerik 840D is also clear and simple on the ShopMill and ShopTurn graphical user interfaces.” The operator can work particularly easily and clearly when a GS 1000/5-FTD with the new Sinumerik Operate user interface is used. Operation and programming always have the same structure, regardless of whether milling or turning processes are to be programmed and set-up. The operator is also supported by graphical displays and animations. Many intelligent functions are available, which are helpful, among other things, for tool and workpiece measurement. The operation and programming of 3+2 axis machining is also supported by the integrated Cycle800 functions. Animated Elements simplify the explanation of functions such as selection of the direction and free running, as well as swiveling.

Another highlight of the new GS 1000/5-FTD is the Sinumerik MDynamics technology package, which is especially important for complex five-axis machining. Maximum surface quality and exact contour accuracy can be achieved even more rapidly. The key is in the new Advanced Surface intelligent path control, which contains an optimized look-ahead function and an optimized online CNC data compressor, among other things. The integrated intelligent jolt limiter relieves stress on the machine mechanics because it enables gentle acceleration and deceleration despite extreme dynamic response.

Customers reap the benefits
As a specialist in single-part and small-series production for small to large workpieces, MCE is equipped to meet even extraordinary demands on-time and with top quality. By equipping its machines with state-of-the-art Siemens technology, the company is able to achieve high throughput times in model production and pass these advantages on to its customers.

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Milling at the Highest Level

The machine tool manufacturer Grob has further developed its standardized five-axis machining centers with a horizontal spindle orientation. The emphasis is on the newly integrated lathe processing capability, the improved features of the high-end Sinumerik 840D sl CNC and the new modern OP 019 Operator Panel screen.

About four years ago, in parallel to its successful system business, Grob-Werke GmbH & Co. KG also began building standard machines that are suitable for use in the entire metal processing industry. The compact five-axis machining center with a footprint of 2.5 m x 4.0 m is extremely efficient and equipped with a horizontally arranged spindle. The G550, a larger model of the same design, with a footprint of 3.8 m x 6.3 m, followed in 2009 and presented a combined mill-turn center for the first time, equipped with the latest version of the Sinumerik 840D sl CNC. According to Peter Hermanns, head of the Standard Machines Department at Grob, the previous version of the horizontal milling center was already an important pre-requisite for hybrid machining: “Our rotary table achieved fast speeds of up to 800 rpm thanks to the maintenance-free torque motors we used.”

Just as important is the extremely stable machine structure with a horizontal spindle arrangement that is advantageous in both turning and milling tasks. The G550 features a long Z path of 1,020 mm and can machine workpieces with diameters of up to 900 mm with tools up to 500 mm long. In practice, the G series has already proven that it is capable of reliably delivering highest-precision tolerances and maximum surface quality in the machining of workpieces. “In addition to high rigidity, our machines have the advantage that the chips fall down freely,” says Hermanns. “This virtually eliminates blocked chips.”

Uniform user interface for milling and turning tasks

In order to exploit the versatile possibilities of the new G550 mill-turn center, the demands on the controller, as well as on the high-quality mechanics, are high. Grob uses the Sinumerik 840D sl, which is acknowledged as the best CNC for such application purposes. It can perform every milling and turning task perfectly, based upon the open architecture of the NC kernel. A particular advantage here is the new Sinumerik Operate user interface, which, thanks to the latest developments, now supports all the common machine kinematics for milling and turning. It was tested in a pilot project by the machine tool specialists at Grob.

Further advantages are the uniform operating structure and the user-friendly cycles, as the experienced Grob application technician and sales consultant Christian Heiss explains: “The programming and setup of milling and turning processes always has the same look and feel and is supported by graphical displays and animations. This is particularly important because the changeover from milling to turning demands a great deal of imagination on the part of the machine operator.” Sinumerik Operate provides additional support here, with a clearly structured tool list that displays all mill and lathe tools. Different programming methods are available: ShopMill for graphically supported, shopfloor-oriented工序 programming, or programGuide (G-code pro-
Programming (which offers extensive cycle support, including all milling, turning and contour cycles).

Increased performance through innovation — emphasis on five-axis machining

The most recently released version of Sinumerik software also offers new features and improvements that are especially useful for tool and mold construction. This further increases surface quality, productivity and precision especially in the area of real five-axis applications — and these improvements are even easier to achieve. One highlight of this innovation is Advanced Surface Stage II with an improved look-ahead capability that allows better surfaces to be achieved immediately. In addition, a function is now available in the ORISON orientation smoothing that makes five-axis milling even easier, more efficient and reliable.

Best overview with a 19 inches screen

The highlights of Sinumerik Operate are particularly evident on the new OP 019 Operator Panel. Real progress has been achieved, according to Heiss: “This new 19 inches user interface is user-friendly, efficient and very clear. The industrial display behind the large glass front has brilliant resolution and glass touchpanels around the edges trigger the functions perfectly. There is no better product available on the market.”

» The new 19 inches user interface of the Sinumerik OP 019 is user-friendly, efficient and very clear. «

Peter Hermanns, head of the Standard Machines Department at Grob (right), and Christian Heiss, application technician, are delighted with the new technology.

Programming with NX-CAM

The more complex the program, the more often external CAD/CAM systems are used. NX-CAM, developed by Siemens, ensures high consistency throughout the process chain. The programs that it creates can easily be transferred to the Sinumerik 840D sl machine controller and used for productive milling. This is one of the main reasons why the workpiece presented live at EMO — the wing mirror of a RUF Porsche — was programmed with NX-CAM.
Weiler Werkzeugmaschinen GmbH, Germany

Easy Operation is a Priority

The conventional lathes from Weiler are highly efficient, easy-to-operate and accurate. A solution developed jointly with Siemens enables much easier operation.

Weiler Werkzeugmaschinen GmbH, based in Emskirchen, Germany, specializes in the development and production of high-precision lathes. As a strategic supplier of large components, the company also manufactures products in its second factory in Holoubkov in the Czech Republic. In addition to supplying products to Weiler, Holoubkov has also had its own radial drilling machine program for many decades. The areas of application in both companies range from machine building, tool- and mold-making — to optical and medical part production — to energy technology and the mineral oil industry. The first positive experiences in partnering with Siemens date back to the time when the company still belonged to the Voest-Alpine Group in Austria. Siemens built the control cabinets for the machine manufacturer at that time. Weiler worked with different providers for the drive and control technology, but the goal was to procure all the components from one manufacturer in order to offer customers better service and optimum spare parts supply worldwide. “We now equip all our product lines with Siemens technology,” explains Armin Daum, head of electrical design and software development at Weiler.

Use of state-of-the-art drive technology

“Together with Siemens, we developed the conventional VC plus lathes. The emphasis is on simple
operation and rapid adaptation to a wide range of machining tasks,” says Daum. By using state-of-the-art drive technology and a display developed jointly by Weiler and Siemens, these machines offer maximum efficiency. The VC plus models are lathes in which the drive speed is controlled continuously by frequency converters. This solution includes drives with control units for control and communication tasks. The machines are equipped with clear Weiler-specific indicating and operating elements. The user is supported in operation by graphics and input masks.

Weiler is the market leader in the segment of cycle-controlled lathes of different sizes for single-part and small-series production. The machines are designed for both manual operation and NC operation. They are equipped with Sinumerik 840D sl CNCs for this purpose. The clear operator panels are specially made and reflect the corporate design of Weiler. Special adapted cycles are available in NC operation.

Good collaboration proven
The DZ CNC-series lathes are designed for complete workpiece machining — with high productivity and maximum accuracy. They are equipped with hollow-shaft motors for the main and subspindles and can be configured with Y-axis and driven tools. All variants are equipped with Sinumerik 840D sl and the Sinamics S120 drive system, into which safety functions are integrated to protect personnel and machines. These functions include the safe turnoff of the drives and the monitoring of speed limits, among other things.

Within the scope of the system partnership, Siemens also produces and supplies prewired control cabinets and pre-assembled cable harnesses. On-time delivery is an important factor for the head of electrical design. “Delivery bottlenecks would delay all further assembly steps,” Daum points out. It is also beneficial that all the components come from one manufacturer. “That ensures that an operator panel fits without problems and a drive harmonizes with the selected controller, for example. With the joint development of the conventional VC plus lathes, we have once more proven the close and effective collaboration and shown that innovative system solutions are also possible in this segment of the market,” Daum concludes.

»While our conventional lathes of the VC plus series operate exclusively with Sinamics S120, all the other product lines are equipped with Sinumerik 840D sl. The great success of the Weiler lathes proves that our decision to establish a system partnership was the right one.«

Armin Daum, head of electrical design and software development at Weiler; Michael Eisler, management executive at Weiler; and Michael Hagel, Siemens sales representative (from right to left), are pleased with the good collaboration.
The Fast Way to the Perfect Shaft

CNC-controlled vertical synchronized-support grinding machines can give motor shafts, gear shafts and even crankshafts the final finish up to 70 percent faster than horizontal grinding machines.

More than seven years ago, EMAG Salach Maschinenfabrik GmbH had the idea to machine shafts vertically. With the synchronized-support grinding machines, a technology for the highly productive manufacture of shafts was developed. Since then, Dr.-Ing. Guido Hegener, the company’s CEO, has seen the development of this technology as a “living process.” The mechanical engineering company chose Siemens’ Sinumerik 840D sl for the control side from the very beginning.

In 2009, the revolutionary synchronized-support grinding machine VTC 315 DS was launched onto the market. Guido Hegener explains the technical principle: “We clamp the shaft to be machined vertically, grind it simultaneously from two sides with high-quality CBN grinding discs, and support it at the same time with a steady rest.” The resulting key advantages soon become evident; it is primarily the normal forces acting in the feed direction that limit the grinding performance, especially on slim and other unstable shafts. To eliminate the tangential forces, the developers at Salach also equipped their machines with an NC-controlled steady rest, which is fitted with high-quality glide materials. The grinding discs both co-rotate and counter-rotate to ensure that no torques act during the grinding process.
The final finish to the shaft up to 70 percent faster

According to EMAG, the sum of these technical functions leads to grinding time reductions of up to 70 percent in comparison with conventional horizontal grinding with corundum discs. Even if CBN tools are used, machining can be 50 percent faster. Tests have also revealed that roundness of 2 µm and radial runout accuracy of <10 µm can be achieved reliably with the synchronized-support grinding machines. Setup of the VTC 315 DS with the vertical structure is also easier, Guido Hegener explains: “The machine operators are not obstructed by any interfering steady rests or clamping systems, and the shafts to be machined can be loaded unobstructed up to a length of 650 mm. And, of course, functions such as the spark-up sensors in the dressing and the automatically balancing system are standard features.”

Since mid-2010, EMAG has also enabled the synchronized-support grinding of crankshafts with its VTC 315 DS. In addition to the stable vertical machine structure, a newly developed eccentric chuck, which adjusts the stroke and pitch automatically, is an important technical basis. Unlike previously known eccentric grinding methods, the chuck no longer has to be set mechanically to a new stroke or pitch but simply has to be reprogrammed. In addition to the main and fitting bearings, flanges, and journals, the lifting bearings can also be made by the classic round grinding method.

CNC highlights — openness and supporting features

In addition to the complex mechanical design, which is necessary for synchronized-support grinding, the control system also plays an important role. The machine manufacturer EMAG relies on Sinumerik CNCs especially in the field of grinding technology. An important reason for this is that the machine tool manufacturer must always respond to individual customer requests and, for example, adapt the number of axes on the control side. “With the Sinumerik 840D sl, this is quite simple. We can create any necessary axis interpolations we like,” explains Wolfgang Rummel, head of Control Technology. The adaptation of the user interface is equally uncomplicated. Software experts from EMAG can generate it quickly and easily using Siemens project tools.

CNC expert Wolfgang Rummel also finds the “generic coupling” developed by Siemens particularly helpful. “This enables us to link various axes easily and reliably in such a way that they move in absolute synchronization.” This is immensely important, especially in synchronized-support grinding, because it is the only way to ensure that the engagement of the two grinding discs and the steady rest takes place at the same time as the final “spark out,” therefore providing a flawless surface.

To protect the expertise for this and other specific customer-developed cycles from piracy, Siemens provides a so-called cycle protection. Wolfgang Rummel explains: “You can imagine this function as a kind of black box that protects our programs against illegal attack from competitors. The expertise for the cycles stays where it belongs — namely, with us.”

> With the Sinumerik 840D sl, we can very easily create any necessary axis interpolations we like and respond individually to customer requests.«

Wolfgang Rummel,
Head of Control Technology at EMAG Salach
Innovative Monitoring System

Genior Modular, the latest Artis solution for tool monitoring, increases the process safety of machine tools — fully automatical and without complex and tedious setting phases.

Undetected problems in machining processes can generate significant costs in mechanical production. For example, undiscovered damage or increased wear on tools can easily lead to serious faults. At the same time, the competitive situation puts pressure on manufacturers to constantly increase the productivity and availability of their plants. The large number of complex monitoring processes can be mastered only with an easily operable monitoring system.

Fully automatic process visualization
Artis GmbH in Bispingen, Germany, a world leader in tool, process and machine condition monitoring and adaptive control (AC) for metal cutting processes, has launched a new type of monitoring system that enables reliable, error-free detection of process faults and works fully automatical.

A main item of the new Genior Modular system is the signal visualization that can be used selectively. With this system, experienced machine operators can detect process anomalies in the early stages and take appropriate countermeasures. One of the prime goals in the development of the visualization software was to find as low-cost a solution as possible for the customer. The high-quality operator panels already present on the machines were therefore used in place of expensive external displays.

Runnable without additional hardware
As a Sinumerik Solution Partner, Artis has been familiar with integration on PCU (Power Control Unit) operator panels for a long time, and the principle is used very successfully by customers. With the Sinumerik 840D sl CNC, the new TCU (Transmission Control Unit) operator panel is becoming increasingly important. The development therefore focused on finding a solution that would run on both operator panels. This was a special challenge for Artis: the software also had to run on the TCU operator panel without additional hardware components.

The close collaboration with Siemens, within the scope of the Solution Partner program, was extremely helpful to Artis in the implementation of the new solution. With this project, Artis became one of the first providers on the market to offer a direct and fully integrated visualization solution — that is, without additional hardware such as PCs or displays — on the latest CNCs such as the Sinumerik 840D sl (PCU and TCU).

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