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- Check against delivery -

„Productivity in Motion - Systems, Solutions, Services“: Siemens at the EMO

Ladies and Gentlemen,

I would also like to bid you a most cordial welcome here to our Chemnitz factory. Dr. Russwurm has given you an overview of our Division and the economic environment we are operating in; he has described major trends and our understanding of technological leadership. I would like to come back briefly to the situation in the machine tools market because this is key to our business. Then I would like to present in detail some select products, systems, solutions and services which we will be showing at the EMO 2003 in Milan, Italy.

The years of rapid growth in the machine tools industry came to an end as the worldwide economic slump took hold in late 2001. During the year that followed, slow innovation rates in the processing industry resulted in double-digit erosion both in the production and consumption of machines worldwide. The situation was worst in the United States, where production declined by over 30 per cent; but other countries including Japan and Switzerland, followed by Germany, were exposed to painful losses. However, there were also countries which showed countercyclical behaviour and boasted positive growth rates. All of these countries are in Asia, with China assuming an outstanding position.

A closer look at the Chinese market reveals that, driven by favourable economic conditions, both production and consumption of machine tools are booming. On a euro basis, China increased its machine tool consumption by 20 per cent last year, attaining the number one position in the world market, ahead of Germany and the United States. This development could well turn out to last for some considerable time, which will give Europe's mechanical engineering companies an opportunity to position themselves in the Chinese market, either by importing their powerful machines to China or by settling there, as has been demonstrated in a number of cases of local commitment. Thanks to our established presence in the Chinese market, in service as well as in development and production, we are in a position to offer our customers the best possible support, and this is what we will set out to do.

Even if the US market has been declining in recent years, its market potential as a consuming country has remained very high. This is largely due to the automotive industry and its vast number of suppliers, both of which find themselves under increased pressure to invest. Early economic indicators have also shown a favourable tendency for a number of months. Against this backdrop, we are expecting an increase in exports to the U.S., even though the strength of the euro is keeping the brakes on at the moment.

Even if the pan-European market is recovering only slowly – favoured by rising sales in Eastern Europe – we can face the remaining months of 2003 with cautious optimism. And if forecasts were based on past economic cycles, then 2004 should see a turnaround.

Motion Control Systems at EMO

The motto of the Motion Control Systems Division at this year's EMO, due to be held from 21 to 28 September 2003 in Milan, is "Productivity in Motion - Systems, Solutions, Services". This covers a wide range of innovative automation solutions, including the latest state-of-the-art and value-added services for machine manufacturers and machine operators alike. We demonstrate the way in which productivity can be enhanced in all phases of the life cycle of a machine tool with the help of innovative products, flexible solutions and tailor-made services from Siemens. Let me now explain in a little more detail where the many customer benefits lie in the course of such a machine life cycle.

- 1. Machine tool design**
- 2. Machine tool construction**
- 3. Machine tool commissioning**
- 4. Machine tool operation at the user**

In order to increase productivity, many different contributing factors need to be examined, all of which mean different things to different people. The machine tool manufacturer requires flexibility, modular design, standardisation, greater dynamics and accuracy, and – last but not least – low development costs and a short development time. Time-to-market is the decisive factor here: In some industries, a delay of six months in launching a new product can lead to loss of the market leadership. To the machine tool user, productivity means high throughput, availability, process security and investment protection, as well as accuracy to gage and surface quality. On a more general scale, productivity in manufacturing means: Networking within an integrated process chain, from the CAD system right up to the tool tip, diagnostics, preventive maintenance and rapid troubleshooting. It is from this perspective that I would now like to take a closer look at some individual innovations and their customer benefits.

1. Machine tool design

During the machine tool design phase, a major course has to be set: This is the phase that decides on whether or not a development can be seen through directly and without any obstacles or stumbling blocks. Here, competent partners at Siemens provide flexible services to support the machine tool manufacturer, thus ensuring that the subsequent engineering process runs more efficiently.

Interdisciplinary work Mechatronic support

Modern production machines are increasingly designed using mechatronic criteria. They consider machine functions in their entirety, with a favourable combination of mechanics, electronics and software promising shorter development times and ensuring the functionality of mature machines. Experts from various disciplines are called upon to consistently translate mechatronic principles into practice. For the machine manufacturer, this means substantial investment in personnel and training resources, imparting knowledge in mechanical engineering as well as software tools. This strong-man act cannot be performed overnight. Closer interdisciplinary work between the mechanical engineer and the drive and automation partner provides a possible solution to this problem. To this end, Siemens has launched its Mechatronic Support service package, which provides support in four stages: Consulting, machine optimisation, machine analysis, and machine simulation with virtual prototyping.

In the first stage of Mechatronic Support, advice is given to customers tackling innovative machine designs with a higher risk potential, such as direct drives and kinematic joining rods. Experienced mechatronics experts are able to identify crucial improvements at an early stage and work out alternative solutions by talking to the user. Machine optimisation is all about activating the hidden reserves of a machine. In many cases, great results can be achieved merely by optimising a controller parameter or other variables in order to increase productivity at little cost and effort.

A machine analysis will reveal where limits exist and why, thus identifying critical machine components. It therefore lends itself to two major tasks: Researching the causes of a fundamental machine problem and reviewing an existing machine. The effects of suggested remedies to a problem can be reliably forecast in the course of a simulation phase. A machine analysis can also benefit the further development of

existing machines. It reveals the innovation potential of a machine platform and the realistic goals which can still be achieved. Simulation based on the data obtained and virtual prototyping help to reliably forecast the expected machine properties.

Mechatronic Support is most effective when it begins in the design phase. Computer-based machine models are used to simulate the machine to be designed. These simulated machine models make it possible for any weaknesses to be identified and resolved in good time, before any mechanical component is even manufactured. A prototype or even a whole pilot series can then be created on the basis of the simulation results. The machine can subsequently be launched quickly with guaranteed productivity and a reduced development risk. Mechatronic Support helps the machine tool manufacturer to save time and money and to take a major step forward in enhancing his market position.

2. Machine tool construction

When developing and building machine tools, manufacturers are increasingly tending to advance into machining-related areas which can be managed using innovative functions and the services of an automation partner.

A single source: All-in equipment

More and more machine manufacturers are returning to their core competence of mechanical engineering. This does not include the construction of switchgear cubicles, which tends to be purchased as a service or product from outside sources, just like any other machine component. Demand is growing for complete single-source solutions. In the search for competent partners, a growing number of machine tool manufacturers manage to find the right partner right here. The Chemnitz solution factory provides tailor-made solutions across the drives and automation spectrum. The secret behind the Chemnitz success story is its broad range of products and services which successfully meet various customer requirements throughout the entire life cycle of switchgear cubicle construction.

Such services range from specific customer consulting activities, via configuration using automation components of the Siemens A&D Group and mechanical and electrical manufacturing, right up to testing, configuration and pre-commissioning.

Wherever the wide range of standard products does not cover the special requirements of a customer, we develop and assemble customer-specific modules and subassemblies at the same site. Sophisticated material logistics involving preferred suppliers coupled with purchasing guidelines tailored to the customer's needs also help to significantly cut costs; in other words, it pays for customers to outsource switchgear cubicle construction to our factory here. Just-in-time supply logistics and flexible ship-to-line concepts round off the range of services that come with our attractive all-in equipment from a single source. Many of our machine tool customers have recognised these advantages, and use them. As a result, some 7,200 switchgear cubicles were shipped from this factory in the course of the past year.

A typical example of the ability to perform is a kind of fitness agenda for the entire equipment range; profit can be demonstrated clearly here. New designs which have been optimised in terms of cost and functionality are generated by an interdisciplinary merger of the mechanical competence of the machine tool manufacturer and the electrical design know-how and expertise of Siemens. The new switchgear cubicle looks significantly less cluttered, operates more reliably and costs less. This will also be demonstrated at the EMO.

“Hybrid” switchgear cubicle

Our willingness to innovate is also demonstrated in the “hybrid” switchgear cubicle, which was developed for the manufacturer of long automatic lathes. This required an extremely compact automation solution which could be accommodated in existing cavities in the machine itself, rather than in a conventional separate switchgear cubicle. This solution saves the user valuable footprint on the shop floor.

Neither does geographical distance hinder close cooperation with a customer, as illustrated by the idea of performing equipment inspections via web cam, which has already been put into practice: Via internet access, the partner at the Solution Factory in Chemnitz can view the respective plant on his screen and control a remote camera to zoom into any machine detail he wishes to inspect more closely. This again increases the productivity and efficiency of a product creation process.

Without belt or gearbox: Economy motor spindle

With the advance of mechatronics from the late Nineties onwards came a wider use of direct drives. Direct drives make machine design and operation simpler: Linear motor instead of the traditional axle drive using motor and ball screw, torque motor for rotary table drives and, finally, complete preassembled drive modules such as motor spindles instead of conventional spindle drives using motor and toothed belt. A typical example will be launched at this year's EMO; it is an 'Economy' motor spindle which is particularly suitable for milling aluminium. With a nominal torque of 30 to 80 Newton meters and maximum speeds of 15,000 to 18,000 revolutions per minute, it rounds off the ECS series at the lower end. It is a complete semi-autonomous functional module, integrating not only motor and spindle but also tool clamping, sensors and detectors. Since there is no belt drive or gearing, it requires much less space than conventional solutions. Moreover, the cartridge design of the ECS makes for quick and easy mounting. Both synchronous and asynchronous motors are available as integrated motors. Synchronous motors provide even better dynamics and improved thermal behaviour. Since there is 90 per cent less power dissipation inside the rotor, bearings do not become as hot, thus reducing spindle expansion and ultimately increasing machine precision and accuracy. Torque is about 60 per cent higher, which means that machine design can be significantly more compact whilst the volume of the core-and-winding assembly remains unchanged. In operation, high torque combined with high speed results in high cutting output and hence shorter machining cycles.

Enhanced performance and connectivity: CNC innovations

Siemens supplies the full range of controls: from simple machine controls right up to high-end CNCs for automation of the most complex machines with up to 248 axes which meet the most stringent requirements in terms of dynamics, precision and surface quality of the workpiece concerned. All product families are continually innovated in order to enhance both the tool machine manufacturer's productivity and that of his customers. At this point, I would like to focus on some selected examples used for Sinumerik 802, Sinumerik 810D and Sinumerik 840D powerline.

Our growth rate in Asia is based in part on the successful Sinumerik 802 models which are easy to operate, and are continually innovated and adapted to meet

customers' growing requirements. Thus, the face-lifted Sinumerik 802S and 802C, now available as the 802S base line and 802C base line all-in operator panel controls, have become even easier to integrate in the machine. This bears out the truth of our motto: "Integration achieves more than interfacing". Combined with analog single and double axle compact drives, Simodrive base line represents the ideal range for automating simple lathes and cutters.

With a view to extending the applications of the cost-effective entry model into the digital CNC world, new functions were added to Sinumerik 802D. Face milling (Transmit) and powered tools favour this control for flexible lathes in particular. Thanks to the newly introduced DP link, it can now be easily integrated into a network with other machines. Beyond the Asian region, this will also benefit users in Europe and America. One of the particular highlights at the EMO will be our remote control via modem, which allows the user's control interface to be displayed on a remote PC, for instance that of the manufacturer. Thus, data input and operation can be remotely managed, which makes it possible to implement new forms of user support and to save time and costs on both fronts. This, again, is a contribution towards increasing productivity.

In the compact Sinumerik 810D, a new CCU 3 has been introduced which is twice as fast as the previous CCU 1 and CCU 2 models. It comes with the same basic software as Sinumerik 840D. This means that almost all the new Sinumerik 840D functions are now also available for the Sinumerik 810D/CCU 3. This represents a major advance from which machine tool manufacturers can benefit in order to automate certain types of machine in a more compact form and at lower cost. Moreover, the full Simodrive range can be used for CCU 3.

New NCUs have been introduced for Sinumerik 840D powerline which are significantly faster than the previous types. Maximum productivity gains are expected to come from Sinumerik 840D powerline's most powerful NCU 573.5. Its wide range of CNC functions corresponds to that of NCU 573.4, but is executed 50 per cent faster. The most impressive new feature of the NCU 573.5 is its new PLC type PLC 317-2 DP, which offers much better performance than the PLC 314-2 DP in NCU 573.4: its speed is double or triple as fast. Its memory has been almost doubled and

the number of functional modules, data modules and inputs/outputs has been significantly increased.

If this performance is still not sufficient for some, they can connect up to 8 NCUs of Sinumerik 840D powerline with a total of 248 axes via a highly dynamic real-time link at interpolator level. This is a new key function for the market sectors which use multi-spindle revolving transfer machines and transfer lines. It performs both interpolation and communication across all NCUs, using an isochronous Profibus with a bandwidth of 12 megabits per second.

Sinumerik operator panels are now available with either the Windows XP or Windows NT operating system. A revised design of the user interface increases the machine's user-friendliness. The same goes for the newly designed handy machine control panels, which make machine operation child's play.

The general demand for integrated networking capabilities has even been taken into account in the smallest operator panel component, the PCU 20. It now comes with an RJ 45 network interface and accepts PC cards for all kinds of purposes.

Curved disc: non-linear axis couplings

In "conventional" mechanical engineering, specific machine functions are achieved via the occasional costly design and combination of mechanical components: these include line shafts, transmissions and couplings, as well as cam controllers for "digital" and cam discs for "analog" functions. In a mechatronic approach, which is an advantageous combination of mechanical and electromechanical components with software, functionality is only partially determined by the mechanical design. The remainder is provided by servo-drives which are controlled by Motion Control software. This increases the productivity of mechanical engineering by providing simple integration of standardised software modules and hardware components. For the user, the decisive criteria include greater machine flexibility and a considerably increased throughput thanks to optimised axle motions and shorter resetting times.

The mechatronic alternative to the above-mentioned mechanical functions is electronic drives. These have been successfully used for fixed transmission ratios for

some considerable time. What is new is the non-linear method of coupling following axes to leading axes via curve tables. In principle, this is done by adding the functionality of a curve table interpolation to the electronic gearing. In complex non-linear functions, one following axis may depend on up to five leading axes. The coupling rule is either a transmission ratio between numerator and denominator or a curve table. In addition, these non-linear axis couplings can also be cascaded to emulate very complex mechanical structures in flexible fashion. Since electronic transmissions have very few mechanical wear parts, the cost of maintenance and service is reduced, while reliability and machine availability are enhanced.

Anti-vibration: Advanced Position Control

A good surface quality of the workpiece is of great importance in tool making and in mould making. Any vibration of a single axis caused by process forces or controller intervention is immediately visible on the surface of the workpiece. With large machines in particular, these marks cannot be entirely avoided because of the mechanical element. A remedy is now available in the form of the new "Advanced Position Control" system for the Sinumerik 840D control, used in conjunction with the new "Performance 2" controller card of the Simodrive 611D drive control. By picking up and processing internal status data from both CNC and drive, these vibrations can be actively cushioned to a degree not achieved by other methods. This means that, in large machines, much higher and more dynamic values can be set for jerk and controller amplification. Machining times are cut by up to 25 per cent and surface quality is improved. The potential productivity gain is extremely evident in this case.

Quick reloading: Consistent openness of control

The term "openness" is currently used to mean so many different things: To some suppliers, openness is an upstream PC. For Sinumerik controls, openness means so much more: Very early on, Siemens recognised the benefit to machine tool manufacturers of a consistently open control across the board. In particular, this allows for the subsequent addition of functions which open up new applications. The Sinumerik 840D is a universal open control: In addition to the user interface, functions of the NC kernel, which controls block call, interpolation and position, can be modified and extended. This enables the control be adapted to specific technological requirements, as is the case in a kinematic real-time transformation for

machining operations based on kinematic joining rods. What are known as compile cycles are programmed in C or C++, tied in with the NC kernel and activated via customer-specific data. Compile cycles are the first choice of specialists who wish to incorporate their technical expertise into the control in order to fully exploit the innovation potential of new machining methods and modern machine designs.

A new feature is the reloadability of compile cycles, which makes customised developments a great deal easier. Only one OEM compile cycle needs to be translated, rather than the entire system. This means that compile cycles from Siemens can be reloaded and combined with OEM compile cycles, thus speeding up the development run.

Value-adding partnership: Solution Provider

The integrated automation of flexible and universal machines to create high productivity increasingly requires additional functionality which is often not part of the core competence of the automation specialist. This includes the monitoring of tools, workpieces and entire machining processes, in-process quality assurance schemes and balancing systems, and many other aspects besides. Successful companies have established themselves in the market to cover these specialised functions, and provide interesting solutions which, however, cannot always be simply added on. They require space in the switchgear cubicle and on the machine, additional sensors, wiring and sometimes even separate operator control and display units. This makes machine operation more complicated, as well as requiring more material and greater integration effort.

Siemens has now created the Solution Provider programme, enabling it to enter into a profitable partnership with a leading company competent in the respective field to provide specific functions – over 30 such partnerships have already been founded. Solution Provider partners take advantage of the consistent openness of the control in both the operator panel and NC kernel area to integrate the required functionality. To ensure smooth interoperability, Solution Providers' products are tested in an Open Architecture laboratory for installability and executability, and products are then certified. This certificate is testimony to a standard of quality which is of equal benefit

to the end customer, machine tool manufacturer, Solution Provider Partner and Siemens alike.

Greater flexibility, design security and shorter times-to-market certainly translate into financial benefits for the machine tool manufacturer. What is more, the integration of previously separate units, displays and operating elements adds to the overall reduction in cost.

We believe that the biggest advantage of the Solution Provider programme for the end customer is that the machine operator can see the entire control picture on a single screen. The integration of previously separate operator control and monitoring units in the Sinumerik operator panel also enhances workers' acceptance of the system, which ultimately also leads to better quality and higher productivity.

More cost-effective manufacturing: Virtual production

New programs for critical workpieces with stringent requirements in terms of machining times and surface quality are often initially run on a trial-and-error basis. If the result does not come up to expectations, the big guessing game begins: was it due to the parts program, the NC, the drives, or even the mechanical parts of the machine? The real machine is like a black box to the user, in other words, he finds it difficult to predict the effect of a possible action on the machining result. A lot of time and material is wasted before a useful setting is found, which often still has plenty of capacity to spare, thus protracting the work unnecessarily.

Optimisation of the dynamic behaviour and surface quality of a workpiece will succeed with the help of "Virtual Production", a Siemens service that comes with its own software tools. Virtual production is performed by a virtual NC machine in three stages, from parts program all the way to the surface of the workpiece.

1. Analysis of the parts program (assumption of an ideal CNC and an ideal machine)
2. Analysis of NC output data (assumption of a real CNC and an ideal machine)
3. Analysis of the machine dynamics (assumption of a real CNC and a real machine)

The third step uses a combination of the machine model taken from the Mechatronic Support simulation and the NC program processing and workpiece visualisation obtained via Virtual Production.

Instead of repeated testing on the real machine, programs can be optimised on the computer without producing any chippings. The criteria applicable to this process of optimisation include minimal processing time and improved surface quality. Gains in time and quality make for increased productivity in batch production at a minimum testing effort.

3. Machine tool commissioning

An important stage between the prototype and batch production of a machine is the initial commissioning, where potential for further productivity gains can be identified. The same applies to the commissioning and acceptance test at the end customer, and this step can be considerably accelerated using new software tools which provide optimum security.

Easy commissioning: Update Agent

The final stage in the development of a machine is its initial commissioning, and the powerful tool known as Sinucom Trace was developed especially to support this process. It is used to obtain traces from PLCs, NCs and drives in a meaningful form and across all component boundaries. Its user-friendly display helps to optimise machines within a much shorter space of time. And machine data sets are also generated which serve as a basis for subsequent batch production of the machine.

The Sinucom ARC program archives and administers the machine data sets thus obtained in extremely flexible fashion. This is particularly true of modular machines, since the program provides automated and secure selection of data sets to be used in the different machine variants. When combined with Sinucom FFS, it considerably shortens the acceptance process. Archiving makes for a high level of data integrity as well as documented product liability tracking, and provides reliable basic data for any service contingencies.

The automated Update Agent process enables service missions to upgrade machines or add new functions at the end user to be completed much more rapidly, as well as in a more secure and, above all, traceable form. In addition, this function is tested at the machine tool manufacturer, then released and burned on CD using the Sinucom UPX expert program. The service staff take this CD to the customer and load it in the machine with the help of the Sinucom UPS service program. This procedure has three major advantages for both parties: Fewer demands are placed on the service staff, while the procedure is also faster, and security is increased.

Safety Integrated made easy: Partially automated acceptance test

Since its launch in 1996, Sinumerik Safety Integrated has proved its worth as a successful comprehensive safety package for protecting individuals and drives alike. It ensures safe and practical machine operation under all specified operating conditions. Highly effective and comprehensive safety functions prompt quick and appropriate responses in the event of a failure, thanks to their integration in drives and controls for speed, standstill and position. As with any drive control, correct parameterisation is essential for reliable, efficient and cost-effective operation. Errors may still creep in, however. To ensure that these are identified in good time, all the safety functions of electrical drive systems have to be tested and logged as part of a machine acceptance test within the scope of the commissioning process. This is done irrespective of whether the safety functions have been implemented by way of Safety Integrated or via an external monitoring or supervising entity. All this takes time, of course.

The partially automated acceptance test with integrated acceptance log to be presented at the EMO gives the machine manufacturer a tool with which he can carry out and log safety function tests quickly and simply. As well as saving time, this tool stands out by virtue of its menu-driven test run and automatic configuration of trace functions. Nothing can get lost, and nothing is forgotten.

The acceptance test can be run in its entirety or in parts and will comply with the future standard IEC 61800-5/2. A full acceptance test examines all specified safety functions, such as compliance with critical values and the proper functioning of control stations or actuators. The entire error reaction chain is tested for all drive

systems, including sensors, controls and actuators. The partial acceptance test only examines the safety-related parameters which have changed in relation to the full acceptance test. The guided functionality of the “partially automated acceptance test” offered by this Safety Integrated tool provides security and saves time. Another contribution to productivity gains – also in the commissioning phase.

4. Machine tool operation at the user

The final consumer or end user of the machine places great importance on high productivity and product quality, as well as on the high availability of production resources. He expects investment protection, as well as low operating costs overall. Let me now present some case studies illustrating the ways in which we are able to provide support in this area.

Modular software design: Motion Control Information System

In order to increase productivity in manufacturing, it is not enough to look at a machine and the way it is automated. Its integration into the entire production environment also has to be considered. This includes IT management components for production data, NC programs, tools, maintenance and service.

Siemens will be launching the new modular “Motion Control Information System”, or MCIS for short, at the EMO. This modular software contains a set of tools used to monitor, administer, maintain and optimise a range of products, from individual machines right up to entire production plants.

MCIS MDA (Machine Data Acquisition) collects machine and operating data such as runtimes or processing times. The great benefit lies in the type of information gained as well as in the transparency of the data acquired. Objective characteristics establish the capacity and output of a machine, identify weaknesses and ensure product quality and process improvement by applying the results of critical data analyses. This increases profits.

A module known as MCIS PMT (Part Monitoring and Tracking) picks up machining and processing results in production and assembly and provides important quality data, also in terms of tracking parts. This may be extremely important as regards

product liability, since the type of process and testing carried out is reliably documented. Costs can also be saved if a product recall becomes necessary, as all the relevant parts are known and exhibit identical properties.

MCIS PDA (Production Data Acquisition) is used to communicate and control production orders. This module supplies precise actual data, making the recalculation of shop orders easier and more accurate.

MCIS DNC (Direct Numerical Control) coordinates, distributes and administers NC machining programs. It reduces costs in the organisation of NC data and helps to manage the diversity of product types in today's extensive product portfolio in cost-effective fashion. This is done by means of an IT bridge between the NC programming system and CNC controlled machines, using the IT infrastructure installed on the customer's premises.

MCIS TDI (Tool Data Information System) is used to administer tools and forecast tool requirements. It increases the efficiency of tool applications and activates reserves which had previously gone unnoticed.

Preventive maintenance of machines and plants is organised on an individual basis by MCIS TPM (Totally Productive Maintenance), taking into account the capacity utilisation of each individual machine. MCIS RCS (Remote Control System) is a service management tool used for corrective maintenance. With its automatic message system across various media and the option of worldwide remote support, it provides transparency and rapid access in all emergencies and across company boundaries. For the machine user, this translates into time savings and cost reductions in the event of a service call.

These modules are scalable from stand-alone machines to entire production plants, and cover a wide range of functions. It is this impressive scope of functions, coupled with optimum interaction via a joint data structure that makes the system so unique. Synergies are gained from the use of all MCIS modules: scope for potential improvement is located, and the profitability of production plants is secured and enhanced in the long term. This again increases productivity.

Everything under the same roof: Job Shop international

Siemens has set new worldwide standards in workshop construction with its Job Shop product family. This places the emphasis on smooth installation and simple operation, since the criterion of usability is becoming increasingly important across the globe: The fast track from the drawing to the workpiece. Program packages such as ShopMill, ShopTurn and ManualTurn, which run on the Sinumerik 810D and 840D platforms, provide the complete user interface. As far as global use goes, they support the CNC programming methods established in the various individual regions. Whereas Europe prefers the graphics-supported work schedule, users in Asia and the U.S. favour DIN/ISO programming using G codes and standard cycles. In the U.S., there is also the need for an interface with CAM systems; here, Ethernet-on-Board is a great advantage when it comes to the fast and safe transmission of large mould-making programs, for example.

The JobShop product family is further developed on an ongoing basis with a view to increasing flexibility and efficiency. A case in point is the “multiple chucking” function in ShopMill, which makes a major contribution to productivity enhancement. The control optimises the tool sequence, thereby reducing non-cutting time. Programs can even be created for machines with reversing chucks in a type of work schedule programming which is easily understood by the skilled worker.

Depending on the type of machine involved, Sinumerik and ShopMill can handle both 3-axes and dynamic 5-axes machining in mould-making applications. The user is supported by what is known as the high-speed setting cycle. All he has to do is to set the desired type of machining, i.e. roughing, smooth-finishing or finishing, and the machining tolerance. The cycle then automatically activates the control parameters required for the selected type of machining without the user having to know the complex control functions involved.

This broad functionality and the flexible choice of programming environments enable the globally operating machine tool manufacturer to serve all markets with just one control, thereby reducing costs at all levels.

Improved 5-axes milling: Spline-oriented tool

Spline interpolation has long been one of the functions of the Sinumerik 840D control. It has proved its worth in so many applications with its swift machining and good surface finish. Double spline interpolation works even faster. Here, both tool path (as before) and tool orientation in 5-axes machining are programmed by spline curves. Curves can be described as polynomes or B splines. This new type of interpolation makes for higher travel speeds and generally calmer operation of the machine, both of which contribute to an improved surface finish. For a consistent process chain from the CAD system to the tip of the tool, it is imperative that this format be supplied by the CAD system. CAD-CATIA, the leading CAD supplier, has been involved in the development process and supports double spline interpolation in its version V5R11.

Predictive maintenance: eP Performance online service

Above and beyond the productivity of a machine or plant, machine users have always kept an eye on TCO, the total cost of ownership. They wish to make better and more effective use of existing production resources via appropriate measures. One such measure is to increase availability by replacing conventional failure-related maintenance by preventive maintenance. The user does not wait until a component or part of the machine fails, then needs to be replaced in a costly and hurried rescue operation while the machine is at a standstill and unproductive. Rather, machine and components are continually monitored and advance warning is given before a possible failure, thereby providing enough time to obtain the necessary spare part and to fit it during a production break.

This type of support is part of the “eP-Performance” service package, which is based on the existing “eP-Access” online service for the remote access to controls in failure-related maintenance. It is used by the machine tool manufacturer’s service and maintenance unit to set up a safe communication link with the control via the internet – as in electronic banking.

The first stage, “eP-Dynamic”, is in charge of managing the failure via the internet, and carries out a simple comparison of data; this is combined with an event-driven

Notification Service and the handling and issuing of what are known as Trouble Tickets.

eP-Performance allows maintenance and service staff worldwide to perform various functions related to condition monitoring of a machine and its components via the internet. Control data from plant operation is picked up, transferred to the ePS host computer, compressed, analysed and made available to the affected party. This allows continuous monitoring and supervision of the status of a machine tool by means of automatically generated test procedures. Trend analyses provide an early indication of critical tendencies in machine components, and suitable remedial actions can be initiated in good time. Preventive maintenance can be precisely planned. The use of these services, which are part of what is known as the second vogue of automation, therefore helps to save time and money on direct intervention, while increasing machine availability in the long term.

Active for longer: Retrofitting with Sinumerik

During times of economic and financial constraint, many users contemplate delaying the purchase of a new machine, preferring instead to extend the service life of existing tried-and-tested machines by appropriate measures. One way to do this is via retrofitting: Overhauling the mechanical parts, fitting modern control systems and possibly even new drives. Its compact design makes Sinumerik 802D the ideal unit for simple integration into existing machine environments. Even in cases where an analog drive control is to be retained, this control is in its element. ± 10 volt output voltage is provided alongside inputs for incremental TTL sensors and a touch probe connection via the bus-driven, analog interface module ADI-4 for four axes.

Conclusion:

As partners in automation, we support and promote the objectives of our customers. For our direct customer, the machine tool manufacturer, this means enhanced competitiveness, since it is more cost-effective and faster for him to launch a new product. To the user of the machine it means increased productivity, investment protection and quality, plus low cost of ownership. This is motivation enough for us to continue our technological leadership, whereby our primary concern is neither to optimise individual components nor to show off our production output data, but rather

to adopt an all-in approach to machines and the manufacturing process chain. Our approach is complemented by new forms of collaboration with our customers and end users. It is this commitment that we intend to demonstrate and illustrate at the EMO in Milan.

Thank you.