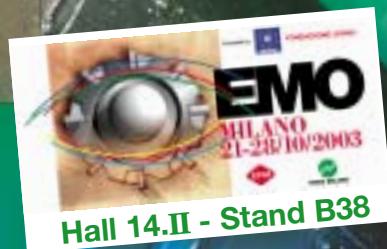


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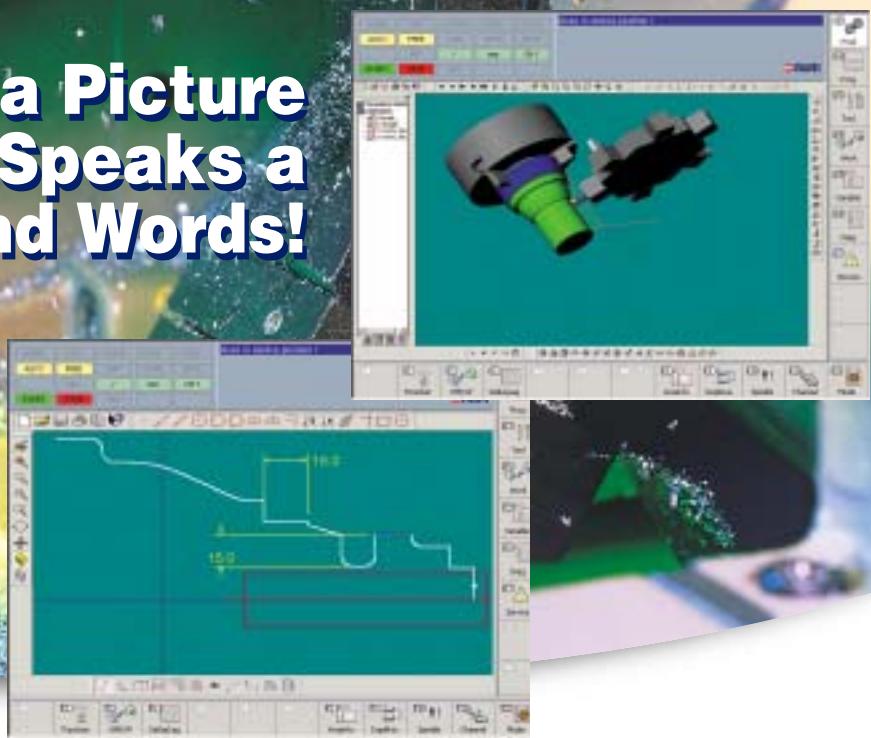
CORPORATE NEWS

Num/Schneider
Electric Synergy

SOLUTIONS

Extension to the
Machining Line
at Dassault Aviation

Because a Picture
Speaks a
Thousand Words!



Schneider
 **Electric**

Num : CNC Complete Solutions

Num/Schneider Electric Synergy: Strategic Assets

To make the most of the advantages of belonging to an international group, Num has decided to develop its synergy within Schneider Electric. Philippe Loirat, General Manager of Schneider's Motion Control activity (of which Num is a part) explains.



The CNC system R&D teams will gradually join forces with Schneider Electric's teams on the Sophia-Antipolis site in the South of France. The organization has already been set up for several people.

What is Num's role in Schneider Electric's strategy?

Schneider Electric has always been determined to ensure the success of the CNC system activity. It is obvious that our customers are now looking for partners who can provide a complete, consistent product line. Because Schneider Electric has asserted its ambition to be present in those markets where Num is a major player, such as machine tool and automotive manufacturers, the CNC activity holds an important place in Schneider Electric's product line. This activity is therefore strategic for the group.

Why strengthen the synergies which already existed between Num and Schneider Electric's activities?

Expert knowledge is necessary today due to technological and technical progress. But Num cannot have experts in all fields: communication networks, human-machine interfaces, etc. Such a wide variety of automatic control application skills require an ever broader range of talents. Furthermore, if you multiply the centers of expertise in a given field, you run the risk of ending up with systems that are not as optimized and interlinked as they could or should be...

Although Num has already worked in collaboration with other units within the group, today's geographic proximity will allow a level of cooperation never achieved before.

Essentially, how will Num be organized?

The CNC system R&D and Marketing departments will gradually be transferred to Sophia-Antipolis in the South of France, on the same site as Schneider Electric's Industrial Automatic Control Development Division. The new organization was set up for one team several months ago. The teams will then be in direct and immediate contact

with Schneider's other automatic control specialists. At the same time, the CNCs themselves are now being produced on the Carros site, Schneider Electric's world center for automatic control product manufacture.

The CNC system's dedicated motors and drives will continue to be produced centrally at Cuggiono, Italy under the control of Schneider Motion. Everything has thus been set up to rigorously manage product interoperation and strengthen development synergies and productivity. The consistency and possible rationalizations between CNC systems, General Motion Control and more broadly Schneider's Industrial Automation products will be guaranteed by a Marketing and Development strategy managed by Alain Digeon, General Manager of Num. In addition to ensuring the cohesion and deployment of the product line, possibly extended by partnerships in all geographic regions, he will also make sure the product line of the Motion Control activity is in line with that of the group.

And commercially?

There are no changes as far as customer contacts are concerned: the France sales teams will remain in the Paris area and all of

Num's commercial activity continues to be managed by Philippe Toinet. His goal is still to develop Num's international activity in the machine tool market with special attention to preferential zones with a high density of manufacturers, such as Germany, Italy, Switzerland, France, etc. In conclusion, I would like to add that Num's restructuring is aimed at making Num more competitive so as to continue developing high performance systems for the lowest price. The only way of doing so effectively was to develop synergies with Schneider Electric to make the most of the group's assets, both for research and logistics. As General Manager of the Motion Control activity, I am sure that Num's repositioning in the Schneider Electric group gives it the leverage it needs to better promote itself in the market and continue to propose tailored and complete systems to its customers, both for the current and future product lines."

**Philippe Loirat,
General Manager
of Schneider's Motion
Control activity:**

"I am sure that Num's repositioning in the Schneider Electric group gives it the leverage it needs to promote itself better on the market and continue to propose adapted and complete systems to its customers, both for the current and future product lines."



Henceforth, Num's CNCs will be produced on the Carros site, where all Schneider Electric's electronic products are manufactured.



Ligna +, EMO 2003 Is a Vintage Year

The year 2003 is significant for trade fairs and shows: Ligna+ - World Fair for Forestry and Wood Industries - took place last May in Hannover and EMO - Trade Fair for World Production of Machine Tools, Systems, Robots and Automation Products - will be held this October 21-28. These two trade fairs are definitely the most impressive in Europe in their category through the number of exhibitors and visitors they attract. With more than 1700 exhibitors, including 51% from abroad, Ligna

was attended by more than 100,000 visitors. Once again, this was the opportunity for Num to demonstrate its leadership in the woodworking industry, both through the number of visitors who came to see Num's booth and the number of CNCs installed on the machines exhibited.

At EMO 2003, Num will showcase its ability to propose complete solutions adapted to the customers' technical and/or economic



requirements, especially through its new Axium Power family.

Always More Responsive to Its Customers

Num has transformed all its commercial subsidiaries into skill centers (Motion Technology Centers (MTC)) to give them greater functional leeway. The new orientation is aimed at increasing their responsiveness. This will make it easier for them to be more than just a hardware or software supplier by proposing a complete line of services totally adapted to the country where they are located. To achieve this, the scope

Because a Picture Speaks a Thousand Words!

What can be more explicit than seeing the part take shape on the screen as the tool moves! The higher the resolution, the more realistic the rendering. This is moreover a recurrent request from CNC users: be able to check on the CNC, using the new simulation technologies, that the part program is correct before starting work. Riding on the crest of its achievements, Num's R&D team have developed a new machining simulation system – a genuine milling or turning CAD/CAM program that will be integrated into the Axium Power.

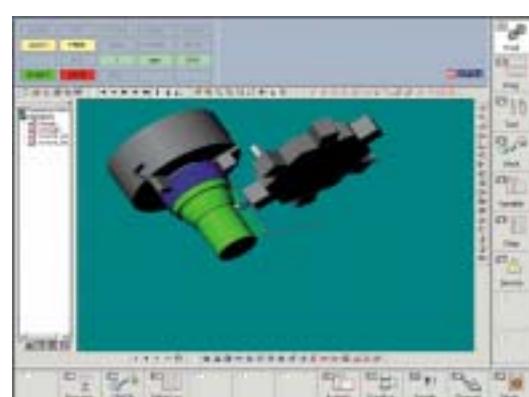
Open and User-Friendly...

..., to remain consistent with the Axium Power philosophy, this 3D graphic program features a Windows® environment and is extremely easy and intuitive to use. Totally integrated with the Axium Power HMI, it allows access at any time to any of the HMI contexts.

The capabilities are complete and multiple: creation of a contour with a 3D view, or of one created/obtained from another CAD program; creation of the part program from a contour based on predefined technological machining

data (CAD/CAM); and, last but not least, simulation of the part program written on Axium Power or in generic ISO format (for programs from other platforms).

This software allows a genuine test to be made of the program, because the operator sees exactly how the machining operations work. For instance, if the OEM or user has defined special cycles, they are included in the simulation. As for the display, the operator can view the finished part (part layout) or the corrected tool path (taking offsets into account). The view can be a wire



frame or a realistic rendering, with or without tool. When the part is shown with the tool, the tool is animated and the various cutting passes are displayed.

Already under test with a few customers, these

new graphic functions will be included later in Num's catalog.



Covering a range of ratings from 5 to 90 A, Num GP Drives are exactly tailored to their market through their modular control section.



Price/Performance Targets Achieved for the Latest Num Drives

Designed for routine applications, Num GP Drives have been optimized to offer an excellent price/performance ratio. Compact, with a built-in power supply and a modular control section, they are exactly tailored to their market. Connected to the CNC system by a DISC NT digital bus, they also have a very fast response time. With an integrated position loop, they provide high resolution interpolation. The result is high machining accuracy and excellent surface finish. Num GP Drives are powered directly from a 230 VAC to 460 VAC three-phase line input and are available in a range of ratings: 5, 9, 15, 22, 30, 45, 60 and 90 A. Num GP Drives are compatible with Num BPH/BPG and SER synchronous motors. For the motor sensor, the user has a choice between resolver and high resolution single-turn or multturn optical sensors. The drives are set up and tested using the Num GPTool. Operation with an external sensor and a variant

without a sensor (open-loop frequency/voltage converter) will also be available. In addition to the standard configuration, Num GP Drives can be supplied with external cooling. In this case, the drive makes practically no contribution to the temperature rise in the cabinet, which greatly simplifies cabinet ventilation.

Retrofit in the Automotive Industry

More Than Durable!

At La Française de Mécanique, the TU assembly line has been running for more than 15 years almost without interruption. An original retrofit operation was therefore decided using a Num Power 1760 kit. Designed to upgrade older machines, especially those equipped with 760 and 750 CNCs, this new CNC replaces the original one without any changes to the part program, wiring or installation. In addition, the ergonomic design is not only preserved, it is improved: having a larger screen with LCD display, etc. So as not to bring production to a halt, the operation was carried out during holidays and at

weekends. The involvement of the operators and maintenance department was remarkable. After more than 15 years of operation, it was normal to count on the experience of the people at La Française de Mécanique. However, this first phase was not sufficient (wiring, checking of the programs and communication, etc.). It was then that the solution available from Num demonstrated its originality and safety.

Just a Few Dozen Minutes to Go Back!

Since it was impossible to be sure that everything was all right from the tests conducted during the first phase, it was deemed better not to take any risks. In a conventional retrofit

case, such a decision could have had serious consequences, since extra work on the wiring of the inputs and outputs could have caused additional errors. The strength of the Num Power 1760 solution is to do away with this risk by using interface cards that allow the original input/output wiring to be preserved. "We were really attracted by this "plug and play" solution," said Alain Genty, from the department where automatic controls are made for PSA Peugeot Citroën at La Française de Mécanique, "because aside from making installation faster, it is very reassuring to know that we can go back to what existed before."

Advantage was taken of the time between the

The retrofitted machine is an assembly machine that attaches the oil pump. In addition to the movements of the screw attachment head, the CNC also manages all the communications concerning the computerized assembly system, the built-in memories, supervision and other safety systems. A major advantage is that this environment is practically the same for all the workstations on the line.



However, re-writing the application and the newly installed technology improved access times to the built-in memories, decreasing the work station cycle time by around 20%! To this was added an improvement in the ergonomics with no disruption for the operators, since the keyboard layout was the same as before.

With the Extension of Its Flexible Machining Line,



Dassault Aviation Combines Flexibility and Productivity!

Dassault Aviation has commissioned its new flexible manufacturing cell. Eight MCM machining centers controlled by 14 Num CNCs, working 24/7, can machine the structural parts required for the manufacture of 12 airframes per month.

Buoyed up by the success of the flexible production line set up at the end of 1997, the PPM (Machined Detail Parts) production unit of Dassault Aviation, located in Argenteuil, France, decided to double the number of machines in its automatic cell. This FMS (Flexible Manufacturing System), around one hundred meters long, now includes eight horizontal spindle MCM machining centers, and is capable of producing 3000 structural parts a month, representing 1200 part numbers. Four hundred different parts can be managed simultaneously and are machined using 2200 tools! Behind the glass-paned wall, you can see the unceasing movement of the shuttles that carry the workpiece-holder pallets from more than 400 locations to the eight machining centers. Placed side by side, the machines work in pairs, sharing tools located (for those most recently installed) in two 600-tool stores.

High Precision Contour Machining Function: Faster and More Accurate!

"This extremely productive cell now replaces many separate machine tools and allowed us to decrease the light alloy cutting time and divide the final cost of the parts by two or three," states Mr. Renouard, head of the PPU production unit at Dassault Aviation. This performance level was of course achieved while continuing to satisfy the exacting precision and surface condition requirements of the airframe manufacturer. Particular care was therefore taken in the mechanical design and control and supervision systems, defined jointly with MCM and Num.

All the machines are controlled by Num CNCs: initially Num 1060s and more recently Num Power 1050s. Their "high precision contour" machining function anticipates the speed to eliminate following error, allowing a significant increase in feed rates and improved machining accuracy. In addition, a special algorithm simultaneously processes sensor inputs from the tilting workpiece table and from the associated servo motors, which effectively eliminates instabilities due to large variations in load inertia. This is essential to prevent oscillations occurring when the fully

loaded table tilts for machining.

Flexible Tool Management

"The key to the flexibility of the system is the supervisor software, which was optimized from the experience gained on the initial line, set up five years ago," states Mr. Renouard. This supervisor, developed by MCM, is constantly in direct communication with the computerized order scheduling system to

manage production in real time, determine which tools are required and sending orders to the presetting shop. The supervisor knows the status of each workpiece, the 2200 tools and the operations in progress, receiving data from the machines via the Num data servers located in the CNCs. The supervisor assigns a machine to perform a task, and in the case of a problem on one machine, assigns another to replace it.

"Computers are one thing," says Mr. Renouard, "but you must not forget the important technical preparation work conducted upstream, which allows the cell to work." In addition to Catia, Dassault System's powerful CAD/CAM program, dedicated programs are used by PPU

to establish work plans, parts lists and instruction sheets, choose tools, etc., which simply highlights the company's know-how.



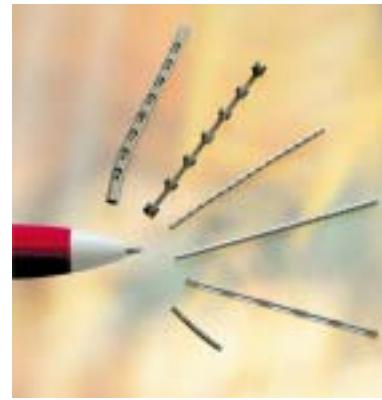
Shuttles carry the workpiece-holder pallets from more than 400 locations to the eight machining centers. Located side by side, the machines work in pairs and share their tools.

This extremely productive cell now replaces many separate machine tools and allowed to divide the final cost of the parts by two or three.



Laser Cutting

State-of-the-Art CNCs for a Cutting-Edge Technology



Laser cutting has been a proven technology for a number of years. A new variant of this technology appeared recently: water-jet-guided laser cutting! Prejet in Switzerland is a specialist in this area.

Prejet produces many parts for medical applications.



Depending on the quantities, it may be more economical to machine parts than to develop a special punch press tool.

Created only a short while ago, Prejet has specialized in water-jet-guided laser cutting. This very recent technology, which appeared less than 10 years ago, overcomes several of the drawbacks of conventional laser cutting. For instance, not only does the waterjet play the role generally performed by optical lenses, it also cools the material being cut. The result is decisive, because the cuts are clean and are less stressed by thermal effects due to the laser. Result: they no longer have that charred look. Another advantage, every bit as important, is that the laser source does not need to be as close to the target. By varying the diameter of the water jet, it is possible to place the part as far as 100 mm away, in comparison with the 30 mm generally required for conventional laser cutting. In addition, the distance does not have to be as constant!

Reproducible Precision of One Micron! Because of its characteristics, water-jet-guided laser cutting can be used to make very small very thin parts with a repeatability equivalent to one micron! That is why certain parts made until now using an electrochemical or EDM process can now be included in Prejet's production schedule. "We have two types of activity," explains Franz Hatebur, Manager of Prejet. "We are subcontractors to companies in the medical sector as well as the clockmaking and even electronic industries. This technology cuts silicon very well. Water-jet-guided laser cutting also has a major advantage in that it optimizes the amount of material removed, which is very significant when the material is expensive! We make nearly 100,000 parts a year for all our customers in all markets. "We also make machines. Since we are expert users of this technology, we knew exactly what other users needed."

Num, Recognized Results for Laser Cutting

The medical and clock-making sectors are areas where the quality and precision of the cut are most important requirements. The machine capabilities are therefore decisive; and consequently those of the CNC as well.

"It is the reputation of Num's CNCs for laser cutting that first led us to choose a Num Power 1050," states Franz Hatebur. "After that, we knew we had made the right choice, because this CNC system has specifications corresponding to our needs for both precision and flexibility, since we produce parts with very different contours. In other words, our machine has to be very versatile!" As a manufacturer, Prejet mainly makes dedicated machines for end users. There is no doubt that the customizability of the Num Power 1050 CNCs was very attractive to the Prejet engineers. Num's engineers contributed a great deal to the success of this application.

They participated in the definition of requirements and also designed and manufactured the control panel, even developing the PLC program. They were thus able to demonstrate Num's ability to act as a partner, capable of giving its customers the benefit of its experience and expertise.



The milling type machine is controlled by a Num Power 1050.

High-Speed Machining Centers and Combined Machines,

Two Investments for DCN Nantes-Indret

To put its know-how to better advantage, DCN Nantes-Indret recently decided to invest in several machines with a high added value. They are all controlled by Num CNCs!

The DCN (Direction des Constructions Navales - National Shipyard Directorate) is associated with illustrious names such as the "Charles de Gaulle" (nuclear-propelled aircraft carrier), "La Fayette" (type of frigate with excellent stealth qualities), etc. Both manufacturer and OEM, DCN has a wide range of expertise in all fields of design and manufacture of warships. This know-how is deployed in eight manufacturing centers. The Nantes-Indret center, develops, builds and integrates complete propulsion systems for surface ships and submarines. Because business was booming, especially on the export market, this unit decided to refurbish a large number of its machine tools. "We decided to focus on complex, large parts, which fully express our know-how," said Jean-Jacques Puaud, in charge of the machining activity on the site. "This led us to invest in high-speed machining centers and combined machines."

Productivity Gains of 30 to 40 Percent
At the beginning of 2003, the Nantes-Indret unit acquired a five-axis high-speed machining center from RGI. Controlled by a fully digital Num 1050 CNC system and designed for machining one-piece copper-aluminum blades and propellers, this milling machine accepts parts 4.7 m in diameter and develops a feed rate of 12,000 mm/min at 24,000 rpm. So far, although prepared with high-speed machining features, it is used for traditional machining operations, optimized only for cutting conditions, but not yet for the tool path. "We are in the process of purchasing a CAM system for 5-axis high-speed machining," said Jean-Jacques Puaud. "Because of the cost of the parts we produce, we cannot make test specimens, so we prefer to proceed one step at a time. But this does not preclude gains in productivity, since this milling machine has already improved our cycle times by 30 to 40 percent. This advance is due to a better chip rate and optimization of the machining cycles." This milling machine has axes that are replaceable on the fly, an original function available with Num CNCs. In this way, work can be performed with dedicated heads

without repositioning the workpiece. This machine has two toolheads: one for roughing and one for 5-axis machining. A third toolhead for 5-axis machining now being purchased will have a pivot point of more than 500 mm. By accurate use of long tools, this toolhead will give access to almost any location on a workpiece, for a very wide range of uses.

For the same reasons of flexibility, replaceable axes were also installed on a combined vertical lathe from the same manufacturer.

Turning, Cylindrical Grinding and 5-Axis Milling

This vertical lathe, also manufactured by RGI, has been operating for two years. Controlled by a Num 1050 CNC, it is characterized by its size and operational flexibility. "We are using this vertical center to machine nuclear components, propeller hubs, mechanical parts, etc. It really has a very wide range of uses," stated Jean-Jacques Puaud.

This CV60 model has four machining heads: turning, cylindrical grinding, 5-axis milling and vertical milling/roughing.

"With this machine, our productivity has increased by 30 percent for pure machining, in particular due to gains in handling, combining operations and the elimination of certain manual grinding operations."

"At the beginning of 2004, we will receive a high-precision turning lathe from Tacchi," added Jean-Jacques Puaud. "With two additional heads for milling and grinding operations and hydrostatic axes ... it will be able to machine diameters of 3.6 m with a distance between centers of 5.5 m. This time, we will benefit from the new Axium Power family," he concluded.



RGI 5-axis milling machine - "With this milling machine, we have already improved our times by 30% to 40%," explained Jean-Jacques Puaud, in charge of machining at DCN Nantes-Indret.

Grinding

Hanchuan Machine Tool Extremely Satisfied with Morara and Num!



The grinding center chosen by Hanchuan Machine Tool is controlled by a Num Power 1050 CNC System.

When a Chinese OEM purchases a machine from another manufacturer, the selection process is very rigorous, especially because of the distances involved. Hanchuan Machine Tool choose a Morara/Num system to machine its tool-holder spindles and cones

Morara has been a grinding specialist since 1934. Today, this Italian company's wide range of products undoubtedly places it among the experts. Its catalog includes machines that are set up and adjusted rapidly due to their mechanical design and their teach-in functions in the CNC. High production machines designed for integration in machining cells are also available from Morara. Compact and high-speed, they feature a very high material removal capability. Last but not least in its catalog are the grinding centers. These high precision machines, can have up to six grinding wheels (internal and external), and can machine complex parts in a single setup. To be able to propose such a wide range of machines, the Italian manufacturer has developed an array of functional modules that can be assembled and adapted to meet the needs of its customers. Final customization in terms of accessories, grinding wheels, etc. permits the specific optimization of the machine to the application. Hanchuan Machine Tools, a major Chinese manufacturer of EDM machines and machining centers (employing 1600), was particularly interested in the grinding centers for machining its spindles and tapered tool-holders.

Where four days were necessary before, the Chinese operators can now grind a part in 8 hours with better surface condition and dimensional precision.



A Single Setup for Internal and External Grinding

The spindle is one of the main components determining the characteristics of any machine. It is the final grinding operations that determine the precision and surface finish of that part. The selection made by Hanchuan Machine Tool was therefore cru-

cial. The decisive factor in the selection was one of the special features of Morara grinding centers, allowing the part to be ground externally and internally without having to remove it. It is obvious that the risk of errors and manufacturing time are decreased by not having to reclamp the workpiece. In the case at hand, the difference was impressive. Whereas four days were necessary before, now the Chinese operators grind a part in just 8 hours. Moreover, the surface condition and dimensional precision are much better. Morara took great care over the design of the machine's measurement and coolant systems.

Joint Advantages

Co-operation between Num and Morara dates back quite a while. The openness and flexibility of Num CNCs are perfectly attuned to Morara's requirements. The openness allowed the Italian manufacturer to easily customize the HMI and interpolator to the grinding environment (using the real-time operators).

Flexibility is essential to the image of responsiveness that Morara is determined to project and preserve. With a less flexible CNC, Morara's modular design strategy would be much less effective.

Grinding is an area where precision is vital. That is why a Num Power 1050 system was chosen for the machine. Its DISC NT digital controller and drives with integrated position loop (high resolution interpolation in the drive) ensure micrometric precision of its movements together with excellent repeatability.

However, Hanchuan Machine Tool would never have accepted a Num CNC if Num had not been able to demonstrate that it could provide a level of service and support in China equivalent to that supplied in Europe. A second grinding center will soon join the first, as soon as the initial twelve-month reliability testing period required by the Chinese is completed.

Non-stop Sharpening with NUMROTOplus® Control!

NUMROTOplus®, the benchmark tool sharpening system, is currently available on 25 different types of machines. For sharpening machines with a workpiece loader, it now includes the NUMROTOplus® Control software package which automatically manages production in total safety.



The Günther Wirth plant includes several sharpening machines, all controlled by Num CNCs and equipped with the NUMROTOplus program.

At the German company GW Günther Wirth, everything turns around hard alloy rotary tools used for drilling, milling, counter-boring and broaching. The company annually sells more than a million tools of this type all over the world. Time is at a premium in this sector. That is why the machines run 24/7. Automation is therefore a necessity. The Michael Deckel S20Num machine is equipped for this purpose with a wheel head changer that can accommodate six wheel heads in a star configuration. Each wheel head can be fitted with up to three grinding wheels. The workpieces are

handled by robot, which takes them from a pallet with 240 locations. For such tool sharpening machines with a workpiece loader, Num also proposes the NUMROTOplus® Control software package which can be used for special production or re-sharpening needs. Part programs are written with NUMROTOplus during the day shift and added to NUMROTOplus Control's job list. The jobs on the list are then automatically executed during the night shift, generally unattended. But this can also maximize production during the day shift as the operator is free to write new part programs while the machine automatically grinds parts already programmed.

The job manager requires a built-in probe on the machine. During large production runs, the blank length is monitored by the probe which also corrects some concentricity errors (clamping error compensation). When re-sharpening a series of tools, the geometric data to be checked includes the diameter, the helix profile and pitch as well as the flute depth and shape variations. Today, practically all the machines on the market have one probe. There is often also a second probe that measures the wheels. After a grinding run, the grinding wheel probe moves over the wheel, checks the quality of the abrasive, measures wear and updates the diameter in the program.

A System That Is Popular with the Personnel

GW's personnel are enthusiastic about the automation system, according to Harald Wirth, Chairman and CEO of the company: "Networking of the high-precision machine with the loader and NUMROTOplus program is flawless and the system is very easy to use." The flexibility is especially significant for the production of special tools. Personnel work on a two day rota while the machines continue working the graveyard shifts. One of the essential

Name	Run	Run	Run	End
1000000000	11	41	00:34	00:15:10
Cutter_Trommel_schleifvorgang	11	31	00:34	00:44:00
12VDC				
1000000000	11	30	00:34	00:29:40
1000000000				00:30
Trommel_Fragt_H44_2_Profil	20	60	00:02	11:20:40
1000000000				
1000000000	11	30	00:22	11:20:00

On this screen, the job list includes five different series of tools (cutters, drill bits, form cutters). For production step 6, the single angle milling cutters already provided with grooves must be completely scanned before being sharpened based on the scan results.

features of the job manager is therefore exception handling (reaction to an unexpected event). If an implausible result is detected during scanning in the middle of a run (for instance if the workpiece is incorrectly clamped in the chuck), production must be able to continue uninterrupted. In this case, the workpiece concerned is returned to its initial location on the pallet. A red dot then appears in the Status column of the job list to indicate the stage of production where the problem occurred. The operator who takes over the machine the next morning can thus immediately identify the defective part. Safety, productivity, user-friendliness... NUMROTOplus® Control really gives an edge over the competition.

Interview of Professor Eberhard Abele, Director of the PTW Institute

“You Have to Consider the Whole System: CAD-CAM/CNC/Motors and Drives/Tooling!”



**Professor
Eberhard Abele,
Director of the PTW
Institute (Produktions-
management,
Technologie und
Werkzeugmaschinen)
in Darmstadt**

In 2000, Professor Eberhard Abele was named director of the renowned PTW Institute of Darmstadt University, succeeding Professor Herbert Schulz. This institute, famous for the quality of its research on machine tools and especially high-speed machining, has been in existence for more than 100 years.

Could you recall the main objectives of the PTW Institute for us?

The Darmstadt institute, created in 1894, is a reference European center for machine tools. In 2001, it was renamed PTW (Produktionsmanagement, Technologie und Werkzeugmaschinen: Production Management, Technology and Machine Tools) Institute, to highlight the extension of its expertise to Production Management and Technology. High-speed machining in particular, on which we have been working for more than 20 years, made it necessary to implement a complete industrial strategy, in which management, technology and production equipment per se are closely linked. In this context, the PTW Institute works on several projects, among which machine tools and components, CAD/CAM and technology (drives and tooling, etc.) are the most important. The themes of these projects are established with some ten industrial partners. A significant factor in our functioning is that 50 percent of our funding is from manufacturers with whom we work very closely.

Before becoming director of this institute, did you have a strong background in industry?

Yes. After studying mechanical engineering at Stuttgart University and completing my research Ph.D., I worked in industry for fifteen years, as R&D/Production Engineering Manager and Technical Manager. During that time, I had the opportunity to implement a CAD system including Feature Technology. This experience showed that it was necessary to take the complete system, including CAD/CAM, CNC, motors and drives and tooling into account to achieve gains in productivity. This conviction gave rise to the European High-Speed Machining awards, held recently in Steyr with an Austrian partner. For the awards, we designed a mold whose features allow reliable measurement of the quality of the work. Last year, the production time for the same part varied from 1 hour and 20 minutes to 8 hours. And it appears that what counts most is how the user controls the complete process to get the most out of it rather than the intrinsic performance of each component of the system.

HIGHLIGHT

So that High-Speed Machining and Composites Get Along Well Together...

During the last ten years, composites have been playing an increasingly predominant role in the aviation industry. For instance, 15 percent of the large size parts on the A340/600 are already made of composite and this percentage will continue to increase substantially on the new generations of aircraft (20 percent on the A380, 30 percent on the A400, 50 percent on the future replacement of the A300 and up to 60 percent on the future replacements of the single aisle family).

This technological evolution from metal to composites involves new constraints for machining in general and high-speed machining in particular that must be catered for by the CNC.

Num recently joined the Composites group of industrial partners, to be in a position to offer services that are perfectly attuned to market needs. This group includes cutting companies, machine shops, universities, engineering schools, etc. Its purpose is to discuss possible uses of composite materials and their consequences in production.

And how do you see development of CAD/CAM systems? Do you think we will see G and M functions disappear, and standard interfaces like STEP become widespread?

Much will depend on the user's area of activity and type of production. Currently, the CAM system determines the production parameters (G and M codes, etc.) based on CAD/CAM data defining the shape to be machined. Then a post-processor adapts these parameters to the machine used. The STEP concept grew out of the need to avoid the last step, which depends excessively on the machine and penalizes any modification of the production process. Darmstadt University moreover contributed significantly to this work. At the time, the aim was to develop a standard. Today, few CAD/CAM suppliers have integrated the STEP concept and the market has considerably changed. Taking the German market as an example, there were 10 CNC

suppliers and 20 CAD/CAM suppliers at the beginning of the 1990s. The multiplicity of possibilities justified the attempt to develop a standard. Today there are only three or four CNC suppliers and five CAD/CAM suppliers. A de facto standard can be expected to appear, due to this decrease in the number of suppliers.

At the same time, needs differ widely for different types of production. Companies with large production runs absolutely need a high performance CAD/CAM system, if only to provide all the documents required by the new legislation. However, a company with very small production runs can have a simple CAD/CAM system, but it may then need the expertise and experience of its programmers to sort out certain details directly on the machine. Similarly, although NURBS functions will inevitably end up prevailing in areas such as mold making and other areas with irregular surfaces, it can be expected that G and M functions will remain an efficient way of programming the machining of cubic parts, such as hydraulic parts.

What changes do you expect to see in high-speed machining during the coming years?

In a drive system, the motor technology determines the choice of the other components. On this level, the appearance of linear motors is definitely a decisive factor. It is true that they have an excellent dynamic range. However, it should be noted that conventional solutions have also

evolved. For instance, hydrostatic ball screws substantially reduce friction to achieve similar performance to linear motors. Under such conditions, it is very likely that the price of linear motors will drop and that combined linear and rotary systems will multiply.

Spindles will probably evolve the most in the coming years. It is true that the use of new modern tools depends on their torque performance. In the future, synchronous motors will most likely be used, because they offer possibilities of more accurate control. In addition, sensors (vibration, force, temperature, moisture, etc.) will be increasingly integrated in the spindle with the aim of optimizing feed rate based on these measurements whilst remaining within predefined capacities and breakage limits. In a way, the purpose is to develop an adaptive control. A "black box" device could also be integrated into the spindles. By recording the measurements just before a failure, it could be possible to determine who is responsible for warranty coverage: machine or spindle manufacturer.



4th International Conference on High-Speed Machining in Darmstadt - Organizer of the conference, the PTW Institute of Darmstadt has been in existence for more than 100 years. It is renowned for its expertise in high-speed machining technology.

Num Invests in High-Speed Machining

Num's interest in high-speed machining goes back a long way. Its R&D in this area has had several innovative spinoffs in its products, such as high precision contour machining algorithms, lookahead, acceleration with controlled jerk, Advanced Resonance Suppression (ARS), smooth interpolation, smart servo balance, etc. to reconcile speed, precision and responsiveness.

Num also participates in many technical seminars with the aim of providing training for users or exchanging experience with other players in this technology. For instance, during the first half of the year, Num participated in the fourth International Conference on Metal Cutting and High-Speed Machining organized by Darmstadt University (PTW) in Germany. The High-Speed Machining technical seminar of the Limoges IUT in France was held at around the same time. Num engineers exhibited the latest Axium Power systems there and demonstrated that high-speed machining did not only mean going faster, but just as



Num's booth at the Fourth International High-Speed Machining Conference in Darmstadt.

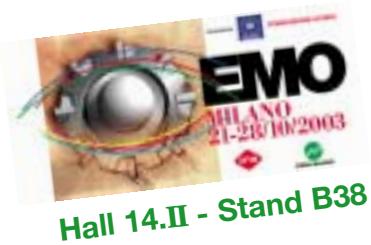
importantly, knowing how to slow down! More recently, during the 11th High Speed Machining seminar in Steyr, Austria, Num confirmed how important the servosystem settings were to fast and accurate machining.

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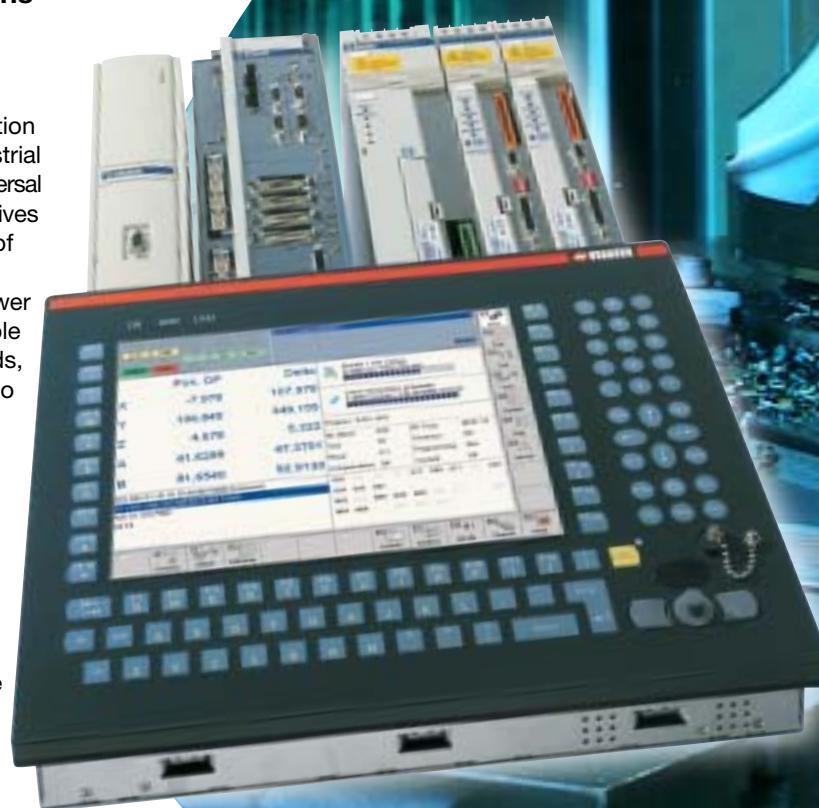


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