

# num

No 37 - September 2002

# information

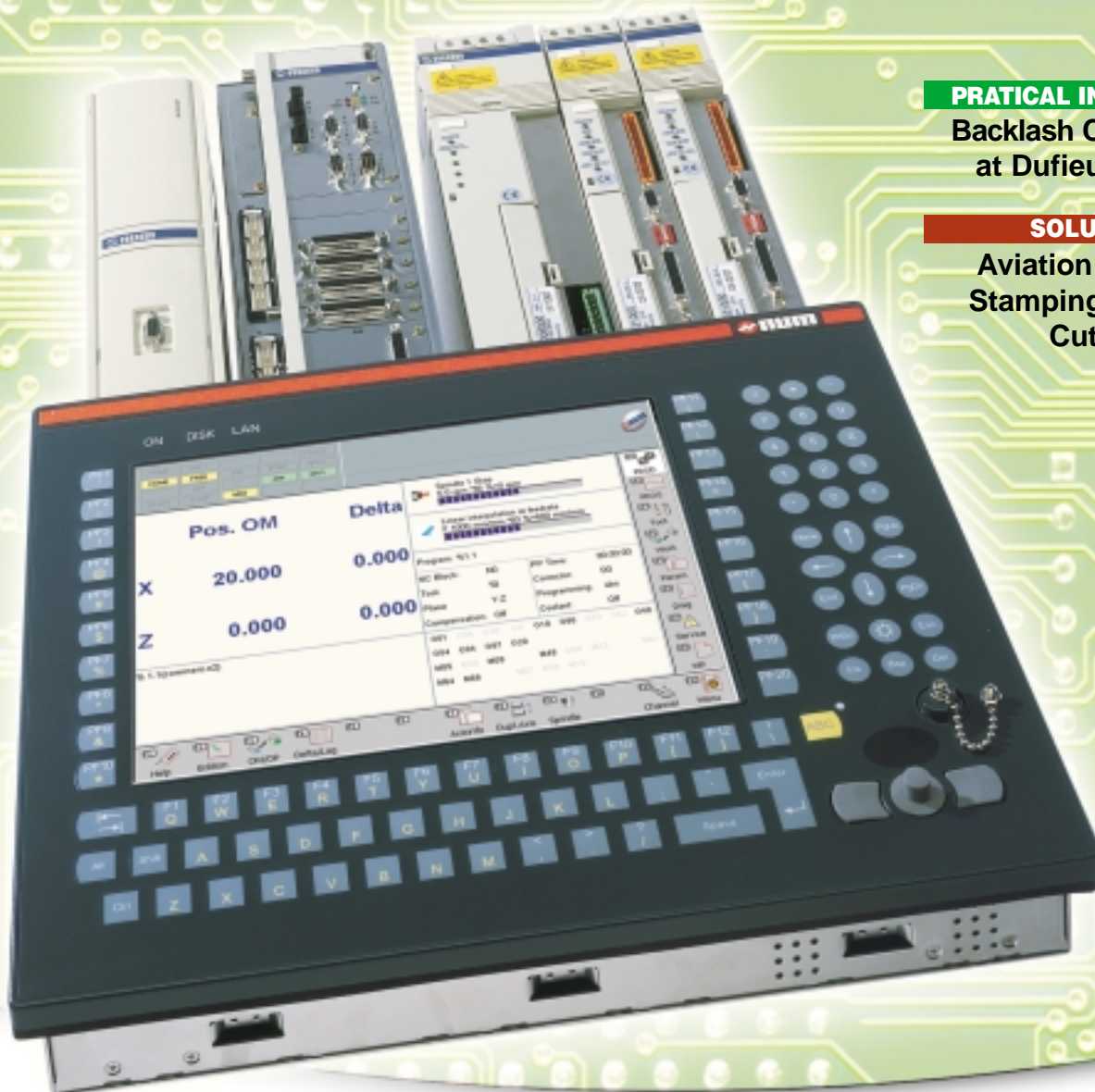
## Axiom Power : General Purpose but Customizable!

### PRactical INFORMATION

Backlash Compensation  
at Dufieux Industrie

### SOLUTIONS

Aviation Industry,  
Stamping, Waterjet  
Cutting





# Axium Power : General Purpose but Customizable!

**Num introduces a new line of fully digital PC-based CNC systems that are especially flexible, open and powerful. Philippe Geiger, Num's Technical Manager, presents this new line for us.**

**Philippe Geiger:**  
**"I believe in a general purpose customizable system, not a standard CNC! That is exactly what Axium Power is."**

**What were your goals in developing Axium Power?**

The success we had with the Num 1050 CNC was a strong incentive to continue our approach. That digital CNC had already demonstrated the high flexibility and performance achieved with our DISC NT architecture. It was therefore completely logical for us to redesign our product line around this architecture, with recognized path following accuracy.

But we were much more ambitious with Axium Power, for which our

goals were more than just performance. We also wanted to offer a flexible, open system.

**What do you mean by flexible?**

Actually, Axium Power can be considered a variable geometry system. The OEM has full freedom for determining exactly the equipment he needs. He chooses the processor, number of axes and spindles and functions he wants, and so forth. This allows him to optimize his choices while keeping his systems totally homogeneous, regardless of the configuration and complexity of his machines.

The trend in machine

tools is increasingly towards combined machines: lathes with milling functions, grinders with turning functions, etc. The automatic control system must be capable of adapting to these new configurations as well as to more conventional machines. That is why I believe in a general purpose customizable system, not a standard CNC. That is exactly what Axium Power is.

**And open?**

We believe the CNC must be able to integrate the specific features of a machine as well as of an application or market. Everything must be done to allow the OEM to customize his system himself or, if he prefers, with our help. But this must be catered for in the design of the CNC system.

For instance, for Axium Power, this led us to develop the human/machine interface in HTML so that all changes and adaptations could be made using off-the-shelf tools.

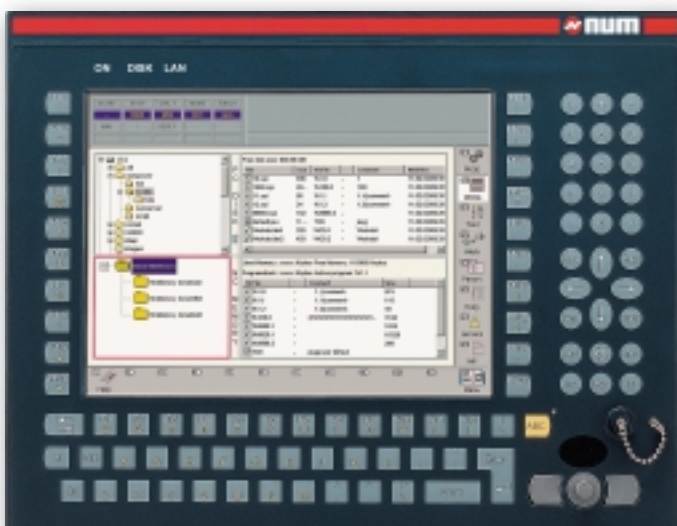
Also, to enhance openness, we are continually designing ever more powerful tools allowing the user to create macros and machining cycles. An OEM needs to stand out from the competition. And the automatic control system is an efficient way of doing so, provided this has been foreseen by the CNC manufacturer!



**The new Num GP Drive family allows Num to propose an even broader line of products to cater for the many different needs of its customers.**

**What specific innovations are available with Axium Power?**

A large number. For instance, the CNC includes state-of-the-art algorithms for improving the quality of machining in general and surface condition or path following in particular. There is smooth interpolation (interpolation on only a few nm), pitch correction, controlled jerk feed rate management, polynomial interpolations, NURBs, look-ahead, etc. One of



**Initially, Axium Power is designed for machines with 1 to 16 axes or spindles and up to 1024 inputs and outputs. With a wide range of available drives, many panels and a vast array of functions, the CNC system can satisfy the needs of many applications on all levels of complexity.**



the original features is the possibility of being able to benefit from all these functions independently of the number of axes. In addition, with Axiom Power, we are introducing two new families of drives. Num HP drives are a complete reengineering of our previous line of digital reference drives. These new models include several new functions such as the ARS system (Advanced Reso-

nance Suppression – see page 4) which intelligently compensates for imperfections in the stiffness of a machine. This system substantially increases the gain of the feedback loop without making the system unstable, even for critical axes. Last but not least, Num HP Drives can control almost all linear motors and torque motors, which is consistent with our ongoing

endeavor to expand capabilities. For more run-of-the-mill applications, we are introducing the Num GP Drive family. With its highly modular control part, this family is fully consistent with Axiom Power's flexible, open approach. More powerful, more flexible, Axiom Power demonstrates Num's ambition to be more and more in tune with market needs.

## Num Strengthens Its Teams



**Philippe Toinet,**  
*International Sales Manager*

**P**hilippe Toinet and Natale Monti have just joined Num, the first as International Sales Manager and the second as Industrial and Logistics Manager.

Philippe Toinet began his career at Schlumberger, then went to Souriau and FCI (second in the world for connectors), where he was until recently Aviation Market Manager. Upon taking his new position, Philippe Toinet stated that he wanted to place his industrial experience at the service of all Num's customers, both manufacturers and end users, at an international level. As he sees it, the best way for Num to strengthen its position around the world is to contribute to its customers' success by meeting their current and future needs.

Since 1982, Natale Monti demonstrated a high level of professionalism at General Electric, where he worked on major industrial programs around the world. This experience allows him to manage the CNC teams in France and motor/drive teams in Italy, place an emphasis on Quality, develop logistical improvements and promote synergies with the Motion Control sphere of Schneider Electric.



**Natale Monti,** *Industrial and Logistics Manager*

### Maintenance for CNC Systems

## L'IRUP and Num Sign a Partnership Agreement

**O**bserving that production plants, industrial repair service companies and machine engineering/reengineering companies needed senior technicians skilled in CNC maintenance, the IRUP (Institut Régional Universitaire

Polytechnique: Regional Polytechnic Community College) organized the Senior CNC Maintenance Technician syllabus.

This 24-month course of study organized as a qualification contract is aimed at providing young vocational high school graduates with a diploma approved by the French Labor Ministry. Alternating periods in school and at work allow the young people to gain on-the-job experience with CNC maintenance and repair and retrofit.

### Num Invests in Training

As training is an integral part of its service concept, Num signed a partnership agreement aimed at supporting IRUP's initiative. Num thereby undertakes to provide equipment of different generations and technologies and to train instructors or supplement their training.

At the same time, Num intends to take advantage of IRUP's teaching experience for setting up predefined and on-demand training courses for people already working professionally. These courses could moreover be organized in the framework of IRUP.



*For additional information on IRUP, contact:*

*Carole Andris: in charge of recruitment and relations with business  
(+33 4 77 91 16 24 – candris@irup.com)*

# Not Only the CNC Needs to Be Open!

**Today, openness and flexibility are essential features in new generation CNC systems. However, not only the CNC should exhibit these two properties. In a well-designed system, they must also be found in the drive.**

The performance of a CNC system now hinges to a great extent on the drive capabilities. The ability of a drive to control a wide variety of mechanical systems is therefore essential as well. That is why the MDLU2 of the Num HP Drive family features such remarkable flexibility.

## From Rotary Motors to Linear Motors

For any pole pitch and all

types of axes, the MDLU2 is able to control synchronous three-phase, rotary and linear motors, a wide range of spindles, asynchronous motors, rotary tables (Direct Drive, etc.). Its large bandwidth plays an essential role in control of linear motors. Since there is very little mechanical damping of linear motors, a large dynamic range is necessary to prevent path errors due to friction and other interference.

However, a large bandwidth can generate increased sensitivity, even to the natural resonance of the machine. To cater for this, the MDLU2 is equipped with five second-order notch filters to reject undesirable frequencies. The full range of the bandwidth is thus available, increasing the quality of the results and the accuracy. To be able to take full advantage of this bandwidth, the position of the motor and of the items it

drives must be accurately known. That is why the sensors are so important.

## All Types of Sensors

The MDLU2 can simultaneously accommodate two position sensors of any type: rotary or linear, absolute or incremental, sinusoidal or TTL encoders, cog wheels or resolvers, regardless of their resolution.

The costs are thereby optimized for each type of machine.

The MDLU2 also includes powerful algorithms for predicting and compensating for resonance and mechanical backlash using the outputs from the motor and load position sensors. This is crucial for the overall machine performance since the conditions of use and any changes subsequent are catered for.

Complex processing of these two inputs makes machining independent of the sensor. Repeatability of performance is thus guaranteed between machines of the same type and even as the sensors age.

Finally, the combination of these functions intelligently compensates for



**The bandwidth of the MDLU (typically 3kHz for a current loop, 300 Hz for a speed loop and 60 Hz for a position loop) gives it a particularly high dynamic range.**

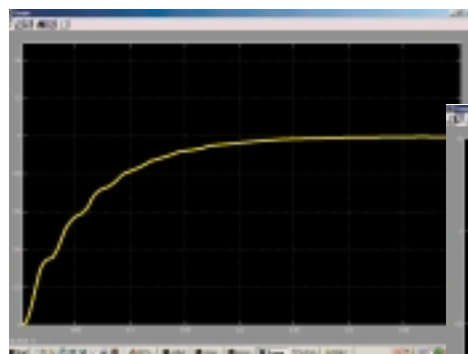
any imperfections in the machine stiffness, ensuring gains heretofore inconceivable with such mechanical systems. This function is called ARS.

## Many Special Functions

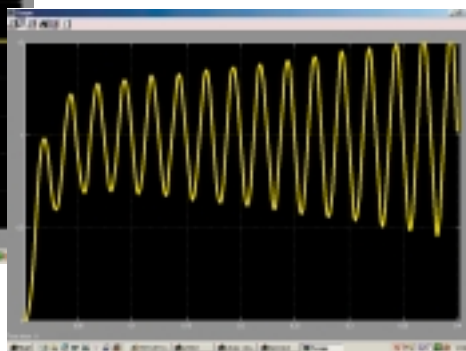
Certain special functions, such as the possibility of working with absolute sensors or being able to identify the "rotor" position without any axis movement, are especially useful for linear motors. This can allow linear motors to be used with incremental sensors.

It then becomes possible to emulate absolute axis measurements using incremental linear sensors and "initializing" their position with the absolute motor sensor, allowing a considerable savings on the sensors used.

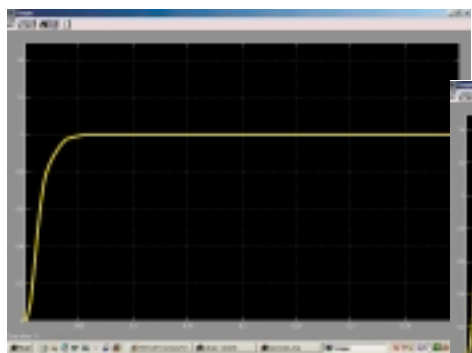
Understanding the problems and proposing general solutions requires complete synergy between the mechanical and electronic systems or, in other words, genuine openness, even for the drive.



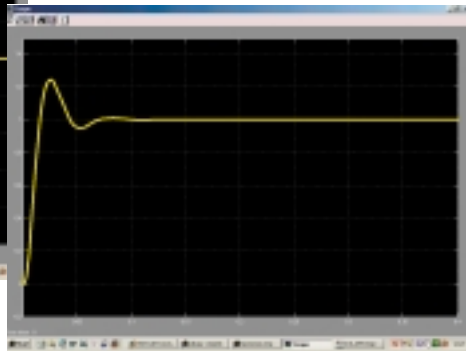
Gain = 1; without ARS



Gain = 2; without ARS



Gain = 4; with ARS



Gain = 10; with ARS

**The ARS function uses the motor and load sensor outputs to enhance the machine responsiveness and decrease the response time.**

## Aviation Industry

# *Snecma Moteurs: Needs May Change, But Num Stays Put!*

**Num CNCs equip many of the machines of the French aircraft engine manufacturer Snecma Moteurs. A new machine equipped with a Num Power 1050 was recently installed at their Corbeil plant.**



**Daniel Boucher,  
Investment Manager  
at Snecma Moteurs.**

**T**he aviation industry is well known for its stringent precision and part quality requirements. Snecma Moteurs' Corbeil plant is no exception, quite the opposite. In its shop, with a floor space of around 85,000 square meters, (including heat treatment,) nearly 850 machines and 400 CNCs, mostly Nums, produce between 100 and 120 engines a month, mainly for civil aviation.

Two major families of parts are made in the Corbeil plant: structural casing type parts (stationary parts) and rotating parts (compressor rotors, shafts, etc.) which require the machining of radically different materials (titanium, special steels, refractory, nickel based, etc.) on parts which, although all cylindrical, are of different diameters and lengths, which lead to the use of suitably adaptable machines.

This is especially true for turning, where horizontal machines are used for shafts and vertical machines for most casings.

The tolerance and surface finish requirements are very stringent, which led to Snecma's most recent acquisition, with a Num Power 1050.

### And then there was the tool...

This Tacchi lathe used for drilling and boring is dedicated to machining engine shafts. "With lengths in excess of 1700 mm and an average 100 mm bore over most of that length, all the parts are made of very hard steels, and the difficulty is in satisfying the tolerances and especially achieving the required surface finish," explains Daniel Boucher, Investment Manager at Snecma Moteurs. "The coolant quality associated with the

bottle boring method and interpolation of the axes supporting the boring tool allows the hole to be bored in a single pass with cuts of up to 14 mm maximum," adds Angelo Malosetti, Technical Manager at Tacchi.

The Num Power 1050 controls seven axes, including two support steadies, as well as the special coolant flow, plus the two spindles. The first spindle is conventionally assigned to the workpiece, whereas the second, in place of the tailstock, is used either as a workpiece support for external turning operations, or a complex system designed to guide the tool during boring operations. Tool guidance must be excellent to achieve the required precision. Guided in a jig bushing by two shoes, the tool has a retractable tip, controlled by the W/U axes of the CNC system. The Num Power 1050 monitors its time-life and feed rate. These two parameters are used to control the speed and can even stop the machine.

Complex machining jobs can be accomplished with the help of automatic controls for pre-setting the tools and for part measurement, plus macro-instructions associated with the graphic display of programmed contours. The regularity and precision of the surface finish not only demonstrate the stability and stiffness of the machine but also the performance of the Num Drive drives and motors, equipped with high resolution absolute encoders.

### Did you say remote maintenance?

Development of this machine required close collaboration between Num and Tacchi and between Snecma Moteurs and Tacchi. This collaboration did not stop with installation of the machine, since a remote maintenance function, facilitated by the design of the Num Power 1050, will allow Tacchi technicians to keep in close touch with the system to provide the best possible support to Snecma Moteurs.



**Tacchi machine  
being set up**



**First spindle  
for the workpiece**



**Second spindle for  
holding the workpiece  
for turning or the tool  
for boring**



## 5-Axis Machining

# Small Production Runs for Large Parts

**The Swiss company Bunorm AG uses only Num CNCs to control its large part machining centers. This single-source concept guarantees high flexibility for this manufacturer, who specializes in small production runs.**



**Urs Morgenthaler, CEO of Bunorm says: "If we were developing a CNC especially for our needs, it would be compact with a large number of drilling and milling cycles and very easy to program for inclined planes. The Num Power 1060 CNC satisfies all these requirements, which is why we chose it."**

surfaces, with X/Y/Z travels of 12,000 mm, 3,500 mm and 1,250 mm, respectively.

The decision to equip these machines with Num CNCs was made 12 years ago. Urs Morgenthaler, CEO of Bunorm, remembers that he needed a five-axis machine on one of the Forest-Liné machines with programming on an inclined plane, that "only Num knew how to do well. We are very satisfied with our decision and continue to choose Num CNCs," he adds, "even though we also looked into the possibilities offered by other CNCs." Urs Morgenthaler has standardised on a single CNC manufacturer and two machine manufacturers. "This makes our operators very versatile, because they are able to work on all the machines." The machines are programmed by an external system, but the operator must be able to make changes at any time.

**B**unorm is accustomed to making parts up to 12 meters long, used for instance in machine beds or frames, parts that first have to be welded then bored. The company has several Forest-Liné and Matek machines for doing this. The largest is a Forest-Liné gantry style machining center with a twist and tilt toolhead, to allow machining on all five

### Ergonomic, Flexible and Compatible

The Num Power 1060 CNC is therefore entirely suited to Urs Morgenthaler's needs. It is ergonomic, compact, and all-inclusive and allows the programs to be operational very rapidly. It is also possible to edit a running programming. "We don't need exotic CNCs which use a special dialog. If we were developing a CNC especially for our needs, it would be compact with a large number of drilling and milling cycles and very easy to program for inclined planes. The Num Power 1060 CNC satisfies all of these requirements, which is why we chose it," continues Urs Morgenthaler. The Num Power 1060 is also very flexible and can run programs written for earlier generations of CNCs without any problem. Urs Morgenthaler points out other advantages of Num CNCs: their availability and ruggedness. They almost never fail. And when they do, Num's product support is very efficient. The fact that Forest-Liné also uses Num Drive systems is another advantage for Urs Morgenthaler: "This means we have only one point of contact for all the electronics. The fact that they are located in Switzerland also gives us the benefits of proximity."



**Both Forest-Liné and Matek machines are controlled by Num CNCs, ensuring the versatility of personnel and programs.**

**With up to 12 meters of travel on the X-axis, this Forest-Liné machine is perfect for machining large machine parts.**



## Stamping



# Digital Technology Opens New Prospects

**Using new technologies to generate gains in productivity and quality is an ambition shared by Num and Texer. This led to close collaboration between the two companies to the great satisfaction of the end customer, Metalsangro.**

**S**pecialized in stamping metal for the automotive industry, Metalsangro, located in Atessa, Italy, recently equipped its production plant with an impressive system including an automatic mechanical press and a flexible part loading/placing/unloading line. The complete system, supplied by Texer, is controlled by a Num Power 1050 digital CNC system.

### High Technology, Flexibility and Ease of Use...

The use of cutting-edge electronics and dedicated software strongly contributed to upgrading the capabilities of the mechanical and hydraulic presses. The handling system now in use at Metalsangro is a complex automated system that is fully synchronized with the mechanical system of the press.

"After thoroughly analyzing available products," explains Marco De Francesco, plant manager, "we chose Texer and Num because their equipment had the essential features we needed, i.e. it was high tech, flexible and easy to use. This allowed us to achieve a high yield and meet better quality standards."

The machine concerned is a Cattaneo press with several workstations. It develops a maximum thrust of 20,000 kN and a speed of 16 blows per minute. Currently, during a complete stamping operation, the plate goes through six workstations.

The handling system includes two transfer units. The first, with three coupled axes (xyz/x'y'z'), is used for gripping the blank, transferring it from one station to the next and positioning it on the work surface.

The second unit with two axes (xz) is the feed unit. This unit takes blanks from three different stacks. In this unit, the unstacking system includes two rotary axes which control gripping of the blanks using linear and circular interpolation. A coordinate converter developed by Num converts the cartesian program written by the operator to rotary motions of the mechanical system. The converter was developed using the Dynamic Operators function featured on Num CNCs.

The position of the ram slide (measured B axis) coordinates the movements of the axes in



**A variant of handling unit #1 allows gripping, transfer and positioning with two axes and a suction type gripper system instead of three coupled axes.**

the first unit based on the settings stored in customization tables. This function (interaxis calibration) resident in the CNC is designed to correct the axis positions with respect to one another. Setting the B axis as primary axis and the axes in the first unit as slave axes allows blank transfer to be totally synchronized with the press movements. Corrections can be made in real time.

### Goals Achieved!

"Num's digital system allowed us to achieve two goals simultaneously," continues Marco De Francesco. "The first was total synchronization between the motion of the transfer bars and the ram slide. Synchronization guarantees both safety and quality. To achieve the same results, it would be necessary to use a machine with polynomial cams, but a mechanical transmission is totally incompatible with the flexibility we require. The flexibility we now have allows us to offer a wider range of services. "Therefore," he concludes, "we can state that digital technology opens new prospects in stamping by improving productivity and quality."



**Transfer from one station to the next**



**Unloading**



## Grinding

# Reliability and Flexibility Contribute to a Good Finish

**The ultramodern grinders and polishing machines from the world leader Berger stand out by the excellent finish obtained. This cutlery grinding specialist tables entirely on Num.**

**T**he German company Heinz Berger Maschinenfabrik proposes a vast range of grinding and polishing machines, with some thirty models and almost 150 variants. They are all designed to machine cutting tools for applications from microsurgery through garden shears to farming tools. With around 25 percent of the world market, Berger is the leader for this type of machines and 80 percent of its production is for the export market.

### A Strong Asset: Reliability

Among the few areas where outside know-how is required, CNCs are an important item. For machines with up to three independent axes, Andreas Groß, Berger's Technical Manager, has been counting on Num products for five years. During this time, he equipped a large number of machines with Num 1040 CNCs.

"We chose the 1040 CNC at the time because it met all our requirements and was an advantageous alternative to our PC-based control."

This choice is now confirmed for other reasons: a very advantageous price/performance ratio, excellent dependability and unparalleled reliability. "I recently had a visit," said Andreas Groß, "from some people in a company that had just started using three of our machines equipped with Num CNCs. A person from maintenance asked me how trouble-shooting worked on the Num. I was embarrassed, because I had no idea what to answer. In five years, we never had any trouble on these CNCs!"

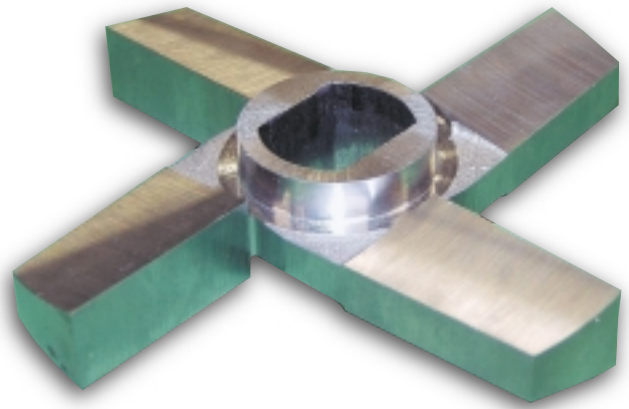
### Fast to Learn and Easy to Use

A new selling point has just been added: the CNC is now equipped with the MMITool human/machine interface development tool.

With its easy-to-program symbols and buttons, the user interface is functional and can be customized for each application. Very little text is required, which is a big advantage for international use. "Considering the share of our export sales, this is an essential factor, because it is very expensive and time-consuming to translate everything into all the languages."

"With graphics," adds Andreas Groß, "you can include an unbelievable amount of information

on the screen. We are also very pleased with the basic concept of the Num Power 1040: communication between the PLC and CNC is very well designed, the basic programming is simple and thanks to the interface developed with MMI-Tool, the end user is efficiently guided during programming. Commissioning is very rapid and remote components can be added to the built-in PLC via a fiber-optic line. And if the user wants to add features later, he can upgrade the CNC." For machines with four or more axes, Berger judges the PC environment more adapted for this application. "It has extra advantages in terms of comfort and features," explains Andreas Groß. "The PC comes with more memory, a floppy disk drive and a CD writer. In addition, running under Windows, it can easily be connected to the Internet using a modem or other components." "Until now, not many PC-based CNCs were available on the market. But now, we are going to seriously look into the new PC-based solution proposed by Num," he concludes.



**This part was machined with the FRS2 machine. This machine can produce circular blades in diameters up to 300 mm. It allows surface grinding and cylindrical grinding at programmed angles to be carried out in a single operation.**



**"During the five years we have been using Num CNC, we have never experienced any failures," says Andreas Groß, Berger Technical Manager.**



# How to Do Something Complicated Easily!

**Waterjet AG: this name is that of the leading Swiss waterjet cutting company. To control a 3D Flow machine, Walter Maurer, CEO of Waterjet, relies entirely on the Num Power 1060 CNC.**



**To obtain a clean cut on round parts, the nozzle must follow the contour, which only a 3D machine can do.**

**N**o matter whether what is to be cut is as thin as cigarette paper or 80 mm thick sheets of aluminum, a waterjet cuts through both with no problem, subject to having the required know-how. Over 13 years, Walter Maurer has gained quite a bit of experience in this area. Today, with his brother, he runs the Swiss company Waterjet AG, which has 18 systems, two of which use the 3D technique for machining crankcases, covers, pipes and castings.

## 3D Requires Great Experience

"A few years ago, we built a prototype 3D system. It had an X/Y table and a rotary axis. At that time, we chose a Num 1040 CNC. We mainly used that system for testing, to gain expertise in 3D cutting."

For the production machine, Waterjet purchased a 3D system from an American company, since taken over by Flow. Walter Maurer wasn't completely satisfied with the American CNC that came with the system. He therefore chose a configuration with a Num Power 1060 CNC. "We were already familiar with the Num CNC from having used it on our test system and we knew how easy it was to use. In addition, it was fairly easy to customize to our needs. For instance, we created a macro that applied an angular correction with respect to the direction of movement." This allowed much better control of the waterjet direction.

The waterjet cutting market is very small, which is why there is so little dedicated software. It is therefore especially important to be able to adapt the CNC to user requirements. And Walter Maurer continues: "Here again, Num has proved very co-operative and assisted us with its know-how and very rapid servicing, with same-day interventions."

## The Num CNC Is Easy to Use...

... compared with other CNCs, an advantage particularly appreciated by Walter Maurer: "This CNC is so simple that we were even able

to develop the post-processor ourselves."

The ease of programming is essential for Waterjet, since around 70 percent of the programming is manual. This task is handled by two mechanical designers specialized in tooling, and with special talents for 3D representation. They are able to enter the programs by basic blocks more rapidly than by starting out with a CAD 3D design. Obviously, this is possible only for relatively simple contours, with very experienced programmers and a CNC that is able to adapt to the special needs of waterjet cutting.

Since know-how plays an essential role, Walter Maurer has expanded his activities. He is chairman of the Swiss Water Cut Association ([www.swc.ch](http://www.swc.ch)) which includes several Swiss waterjet cutting specialists. This association facilitates exchanges of information and can lead to collaborations. Walter Maurer is also a member of the Schweizerisches Kompetenzzentrum für Wasserstrahltechnologie (SKWT: Swiss skill center for waterjet cutting technology). This skill center conducts research, development, assistance and service activities with a strong focus on applications.

**The Flow machine equipped with a Num Power 1060 CNC is perfect for 3D work.**



# Backlash Compensation A Function Worth Having...

**In automatic control systems, backlash compensation is an efficient way of reinforcing machine stiffness. The two applications developed by Dufieux Industrie are a good illustration of this.**



**Dufieux Industrie turning-milling machine being assembled and its 4.5 m turntable.**

**R**ack-and-pinion transmissions are traditionally used for axis travel exceeding 4 meters in the case of linear axes or to move a turntable. Despite all the care taken, backlash is not uncommon, and takes a toll on the transmission system gear teeth, especially when the travel is long and the accelerations are high.

To guarantee backlash-free operation, this type of transmission is often used in conjunction with a preload system consisting of a deformable component, a sort of "industrial spring". The internal loads generated by the preload loop keep the gear teeth applied at all times with no backlash, guaranteeing a certain stiffness between the point of

application of the preload and the rack.

The main drawbacks of the preload system are both technical and economic. First of all, the investment cost is high (around €50,000) as are maintenance costs, since the preload components age fairly fast. The system is also often bulky and great dexterity is required to adjust the preloading springs and hydraulic actuators. Last but not least, the resulting stiffness is limited and depends on the number of intermediate shafts interposed between the motor and drive gears.

That is why OEMs today generally prefer electrical preloading systems using a feedback mechanism.

## Principle of the Function on MDL02

The backlash compensation system, developed

by Num, includes two tandem motors used to electrically preload the components of a transmission system with normal backlash (rack-and-pinions or pinion-pinion) (see drawing next page).

Each of these motors supplies an acceleration or braking torque whose resultant ensures acceleration (or deceleration) of the slide (tandem control) and an opposing preload torque keeping the gear teeth applied, thereby eliminating the adverse effect of backlash (preload torque).

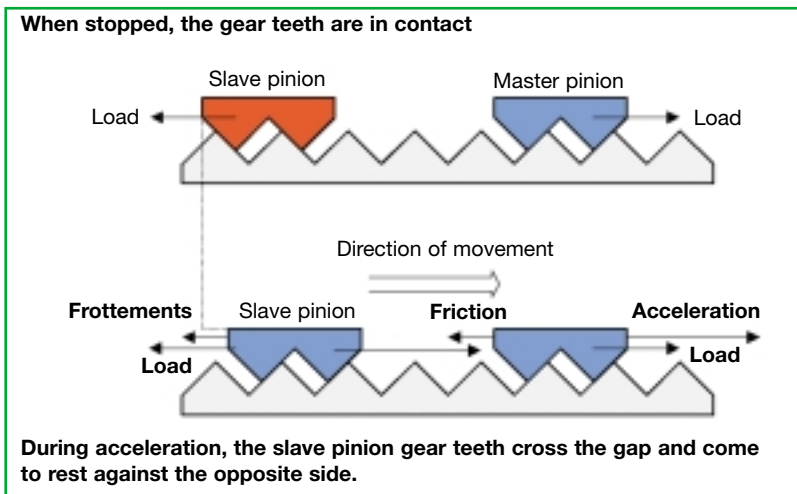
To optimize security, the preloading torques are applied gradually when the drives are turned on, to prevent snapping of the gear teeth.

A preload control system sensitive to the difference in acceleration between the two motors eliminates any risk of shock between gear teeth

and instability during transient accelerations and decelerations. This system tends to make the dynamic behavior of two tandem motors identical. Compared with conventional preload systems, backlash compensation by tandem motors has the dual advantage of being reliable and economic. In addition, it simplifies the mechanics and is easier to adjust and maintain. Last but not least, it affords much higher stiffness by preloading the mechanical components.

## Dufieux Industrie: Two Characteristic Applications

The experience of Dufieux Industrie is very interesting in that this company has implemented backlash compensation on both mechanical architectures: linear and rotary axes. The first example is a double gantry milling machine with a travel of



## HIGHLIGHT

## Dufieux Industrie, A General Manufacturer Doing Well

**B**ased in France, Dufieux Industrie designs, produces and markets many types of special machine tools for medium and heavy industry. An authentic general manufacturer, Dufieux Industrie proposes machines meeting the specifications of major manufacturers in milling, turning, vertical grinding and machining centers for applications in the aviation, automotive tooling, energy, rail and steel industries.



14 m. It was thus naturally equipped with a rack. The second includes a turntable with a diameter of 4.5 m. It performs turning and milling operations. For turning, the turntable rotates at speeds up to 100 rpm, and backlash compensation is inoperative. However, for milling, the same turntable is

required to perform movements accurate to within a few thousandths of a degree. The two machines, intended for the aviation industry, had to satisfy accuracy requirements demanding high stiffness. "Backlash compensation considerably simplified the assembly process," remark Pierre Yves

Foissac, Technical Manager, and Elvio Sedran, Automatic Controls Manager at Dufieux Industrie. "With two servomotors and two standard reduction gears, setup is simplified and optimization is rapid. In addition, we can be especially confident for the future: any drifts in preloads are automatically

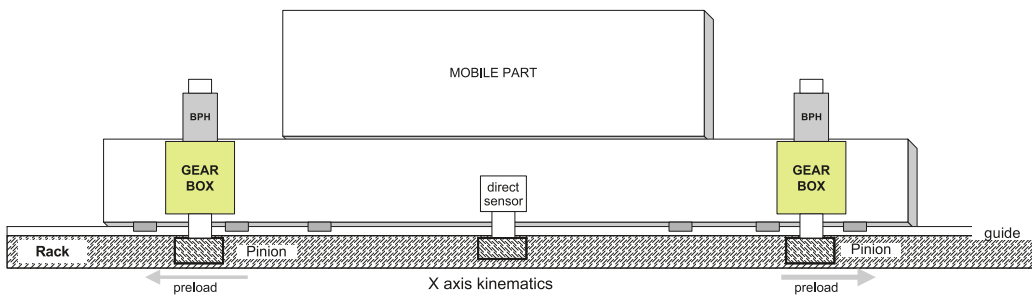
compensated for without having to perform any readjustments!" "Finally," they conclude, "considering the load distribution, the drive dimensions can be optimized." In other words, backlash compensation is really a function worth having!

**HIGHLIGHT**

**Tandem: An Optimized Package**

**W**ithin a function called Tandem, Num associated several algorithms designed for applications using two or more motors with interdependent controls. In addition to backlash compensation (see opposite), the Tandem function includes torque duplication and synchronization. Used together or separately depending on needs, these functions ensure excellent coordination of mechanically linked movements.

**Backlash compensation function**



Electrical preloading system and drive system with two tandem motors

**PheNumenal!**

What if the performance of a CNC system is so astounding that a manufacturer decides to name a machine after it? It's fairly unusual, but Michael Deckel did just that for his latest grinding machine. The machine is called

S20Num, and its advertising explicitly mentions the use of a Num 1050 CNC running the NUM-ROTOplus® software. We are very grateful for this demonstration of confidence. Maybe it will be an inspiration to others...

**PhäNUMenal:**  
die S20NUM von Deckel

- > 5-achsiges CNC-Werkzeugschleifmaschine mit NUMROTOplus-Software
- > voll digitale NUM 1050 Steuerung
- > patentiertes Vertikalprinzip mit phänomenalen Vorteilen
- > Schleifzylinder-Schnellwechsellinrichtung
- > direkter Spindeltrieb
- > Roboter-Laden: Schwenkpalette mit 2 mal 120 Magazinplätzen für Werkzeuge mit einem Durchmesser Ø von 6 bis 32 mm

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**Num Goes to the Show...**

Presented at all the trade fairs and shows during the first half of 2002 (see schedule in Num Info 36), Axium Power was a great success. Many customers from different sectors of activity were very interested in this new system.

For the second half of the year, we will be happy to show you Axium Power's features even better at:

**September**  
**MSV 2002**  
16 - 20 September



Brno - Czech Republic

**October**  
**Bimu**  
3 - 8 October



Milano / Italy

**Transfométal**  
15 - 19 October



Lyon / France

**November**  
**EMAF**  
13 - 17 November



Oporto / Portugal

**Educatec**  
20 - 23 November



Paris - Porte de Versailles / France

**SPS - IPC - Drives**  
26 - 28 November



Nuremberg / Germany

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[www.schneider-num.co.uk](http://www.schneider-num.co.uk)  
Editor: Laurence Petitguyot  
Realized by: AVANA  
Orléans (France)  
33 2 38 77 88 88  
ISSN 0248-7306  
3rd quarter 2002

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