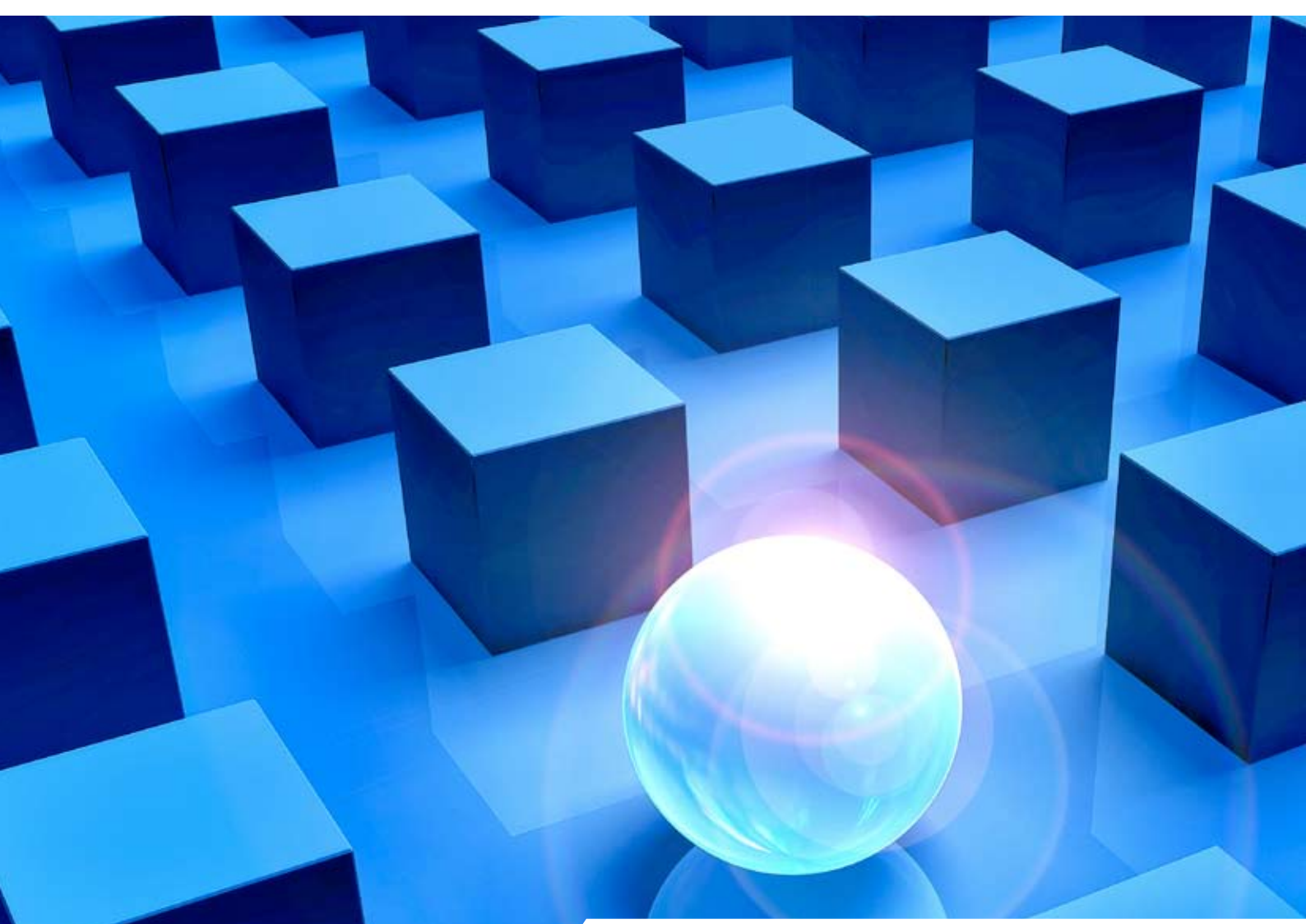


NUM

information

JOURNAL FOR CNC-TOTAL SOLUTIONS

No 51 - March 2011



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Words from our CEO

Dear readers,

Many businesses today attempt to find the edge on their competitors using USPs (Unique Selling Proposition). For companies working in the retail market business, this is mainly about the price. For companies working in niche markets, it looks rather different. Here other factors play a role alongside the price, which of course also has to be right.

On the whole, we have found that products are increasingly similar, which causes a "uniform mainstream" to emerge. For instance, we can see this in everyday products such as washing detergents, food, cars, TV shows etc. Companies gear themselves towards the achievements of successful market leaders in order to emulate their approaches for their own purposes. Other products are analysed and evaluated so as to gain a competitive advantage for their own products. However, if

you only do the same as your competitors, you can only ever be as good as them, never better. To really pull away from the mainstream you need to be innovative. One major inventor who has shown us the

To distinguish ourselves on the market today, we must be prepared to absorb ideas and develop them into unique solutions. These innovations are the key to success, not copying blindly from others.

„Let's say goodbye to mediocrity and mainstream and hello to our unique solutions.“

(Peter von Rüti, President & CEO NUM Group)

way was Thomas A. Edison. One of his quotes is: "I'm a good sponge because I absorb ideas and then put them to practical use." Edison didn't just come up with new ideas, he also made use of existing ideas and put them to practical use in his specific project. In doing this, he created an amazing variety of practical inventions.

We support our partners in introducing state-of-the-art, unique solutions onto the market. On the following pages, you can find out how we achieve this with our partners and customers. Our unconventional solutions have a long history and tradition. You can find an example in the article on page 4 (Ekofisk Project).

Thanks to all this experience, we are able to present custom-made solutions today and in the future. All credit to our staff, who are tireless in the search for new solutions with machine manufacturers and users.

Let's say goodbye to mediocrity and the mainstream with our unique solutions.

Impressum

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Peter von Rüti
President & CEO NUM Group

NUM attending TIMTOS 2011 in Taipei, Taiwan

The 2011 Taipei International Machine Tool Show (TIMTOS 2011) is taking place from March 1 to 6, 2011. NUM will for the first time also be among the exhibitors with his own stand in the Swiss Pavilion, organized by the Trade Office of Swiss Industries (TOSI) in Taipei, Taiwan.

The biennial exhibition has already become a focus for international buyers, and the upcoming 15th TIMTOS is sure to be a prominent international event in the industry. After a the successful turnout of the TIMTOS 2009 exhibition, NUM decided to play an active role at the 2011 exhibition. As an exhibitor we will promote the large range of NUM products and services to visitors, potential customers as well as our existing customers. We would be very happy to welcome you at our stand at the TIMTOS 2011.



NUM Event Calendar



TIMTOS

From 1st - 6th March 2011 in Taipei, Taiwan



CIMT

From 11th - 16th April 2011 in Peking, China



EPMT

From 24th - 27th May 2011 in Lausanne, Switzerland



Airshow Paris Le Bourget

From 20th - 26th June 2011 in Paris, France



EMO Hannover

From 19th - 24th September 2011 in Hannover, Germany

Events



Only 10 minutes lifetime... ...several weeks of production time

NUM technology has featured in the manufacturing of parts for some very unusual 'one-shot' products, such as jacking-up oil rigs in the North Sea Ekofisk field. Jobs like these often have similar scenarios: they are a completely new application, no rehearsal is possible, and there is no second chance.



Ekofisk 1987, a unique project, even back then



Views of the tank after bending and after sheet metal feeding



The latest example is quite spectacular: it's fitted on something weighing over 200 tonnes, filled with 160 tonnes of liquid hydrogen and oxygen at 253°C, and accelerating up to 25'000 km/hour. If we mention the customer is Astrium, Europe's leading space company – it's clear what we're talking about. This challenge is a part of the Ariane rocket – the cryogenic tank to be precise. It's easy to see that the smallest imperfection could lead to a \$200 million fireworks display. The chosen suppliers have to be able to prove the quality and reliability of their solution.

The cryogenic tank is an assembly of aluminum panels. The tank is so precisely optimized for its role that it needs to be protected by inflation in order not to collapse under its own weight during transportation, before receiving its load of highly volatile propellant. The technical challenge is to shape these panels with the highest accuracy. Unlike the tank's flat external faces, internal surfaces are full of grooves and reinforcements – all of which are a potential obstacle or weakness point if not properly designed and fabricated.

Alongside the technical challenge was an organizational one. Fabrication relied on an ageing machine with a custom-made control system

that was becoming more and more difficult to maintain. And the supplier was subject to onerous contractual requirements. To help ensure the success of the project, NUM partnered with SRMO (<http://www.groupe-ledoux.com>) to propose a solution for refurbishing the critical machine. While SRMO took care of the machinery itself, NUM took responsibility for updating the control system and user interface.

The fabrication process for the cryogenic tank involves up to 250 bending operations for each panel – with precise control over the force, amplitude and pitch of each individual bend. Each of 37 individual segments of the lower section of the bending die need to be positioned accurately in order to prevent collisions. However, even though the fabrication process is automated, this is not mass production, and small deviations can occur. It is sometimes necessary to re-execute a machining operation or to adjust the parameters slightly, and final quality relies on the skilled operator's know-how.

The control system had to ensure that there was no interference between the dies and the part. And keeping track of every single operation for traceability reasons was also mandatory.

With 39 axes to control, plus requirements including traceability, the ability to remotely diagnose faults, sophisticated file management, and an application-specific user interface, this was a perfect target for NUM's new Flexium system - with NUMDriveC drives and BHX servo motors.

NUM's solution is based on a Flexium 68 CNC kernel controlling 19 CANopen dual-axis drives, two hydraulic axes (with synchronization and differential adjustment), together with distributed I/O modules and other accessories. One other key requirement was software utilities which ensured that validated data from the previous system could be used to generate part program files automatically.

Operations, compensations and incidents are all dated and recorded in a dedicated traceability file for each part. The whole process is under control of a scheduler, allowing the possibility of manual intervention at any time, while also securing all moves.

The user interface is fully graphic with several frames. One permanently displays the lower dies as well as the part shape. Potential collisions are detected in advance, and shown as an alert.

A live simulator installed at NUM allowed the engineering team to fully qualify the application, and to subsequently prove the functionality and quality of the solution to the client. Once the concept was validated by Astrium, work started in May 2009. Given the strict schedule, the SRMO and NUM teams on site didn't get much free time. Very often 'dinner' was found at the last drive-in restaurant open in the area. But, thanks to well defined timing and close cooperation, the project was still completed slightly ahead of schedule - and since then dozens of tank parts have been produced.

We believe this project truly exemplifies NUM's mission statement of being a one-stop 'high end CNC

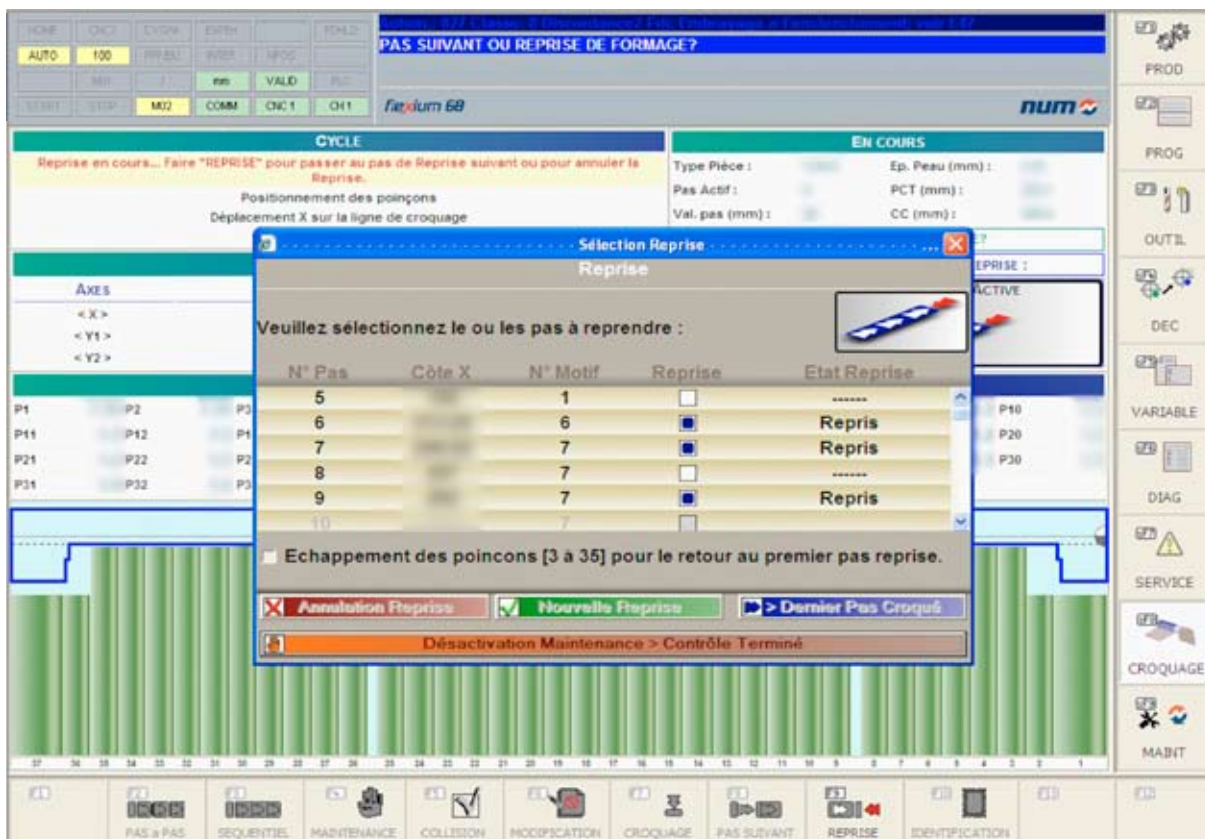


Command post

solutions' provider. But our point of view is not what really matters; let's find out what our customer, Mr. Philippe Verger, Industrial Means Maintenance Responsible, EADS les Mureaux, had to say:

"The Astrium decision committee for this project did select the SRMO/NUM joint proposal because it offered the best technical approach considering the requirements. Even though the CNC was new we were made confident it will provide the adequate performances to control the large number of axes of this cell. A second key element in this decision making process was the long lasting partnership and the complete dedication of NUM to succeed in this crucial project. The teams were highly committed, they spared no effort to achieve the goal within the requested timeframe, all this to the user's full satisfaction."

View of specific HMI. Machine preparing to restart certain operations.



Challenge



The peak of shaping, engraving, sawing, polishing & turning

Located in the Italian Alpine region, OMAG was founded in 1979 by Angelo Albani to develop specialized machinery for processing marble, granite, prophyratic and sedimentary stone and glass. Now after over 30 years, OMAG is an acknowledged leader in the field, with a constantly expanding product line to meet changing requirements. During much of this period – for over 20 years – NUM has been an important technology partner to OMAG.

One striking advantage that OMAG has over its competitors is its large size and its major investment in modern machinery – with many numerically controlled machines running NUM-developed application software. These resources permit extensive testing of

different machining concepts, tools and materials. The company's in-depth experience with computerized manufacturing aids the collaboration process with NUM – helping the partners to create and refine advanced machine control software that is ex-

haustively tested and trialled prior to commercial release.

Custom machinery

An advantage of this collaboration process for OMAG's customers is the extensive application-specific capability that may be applied to machinery.

Blade5 – Z vertical axis up to 3.000 mm

The aim of both companies is to engage very closely with the customer in the project planning phase, which helps to build a strong cooperation and trust. Once the needs of the customer have been analysed in fine detail, OMAG is able to propose a suitable machine, including specially-adapted application software from NUM.

Both companies also guarantee not only professional installation and commissioning of a machine, but also extensive training of all the operating personnel. As NUM and OMAG both share similar business philosophies, then the relationship between the customer and the machine builder does not end there. Support continues until the customer is able to use the equipment to its full potential. And OMAG and NUM remain available for technical advice and training throughout the machinery's lifecycle. OMAG and NUM also offer service and maintenance of their products for life-





blade5

NUM 
CNC HighEnd Applications



NUM Drive amplifier
MDLL and MDL3

5 Axis interpolated



time of the machine – at which point there are almost invariably refurbishment choices as well as new machine options.

OMAG's newest product – 'Blade5' – is a numerically-controlled (NC) machining centre with from 5 to 12 axes. It combines the functions of a former and a lathe in a single unit. The exceptional capability of Blade5 – developed by drawing on over 30 years of specialized machine building experi-

ence – sets a new standard for forming, routing, engraving, milling, sculpting, sawing, polishing and turning work on all types of stone and glass. Blade5 is equally suited to high output on-line production and single, one-off pieces. The machine's axes are driven at high speed by brushless motors developed by NUM, combined with ball bearing screws and linear guides with ball runners; all these parts are protected by PVC bellows and lubricated with oil by a controlled centralized system.

The machine's mobile bridge technology makes Blade5 a highly modular platform – allowing enhancements such as a lathe function or extension of the work area to be added easily at a later date as a customer's requirements evolve. A key element of the machine is a powerful new spindle based on a liquid-cooled synchronous motor, with a continuous power rating of 25 kW at 1000 RPM, a maximum speed of 8000 RPM and a peak torque capability of 400 Nm.

The motor is also isolated from other active spindle parts – enhancing both the smoothness and rigidity of the machine's operation. The NC software is supplied by NUM, complementing OMAG's easy to learn and simple to operate CAD/CAM software.



from left to right:

Mr. Angelo Albani
OMAG Chairman

Mr. Marco Battistotti
NUM NTC Manager, NUM Italy

Mr. Marco Cavalleri
OMAG Managing Director

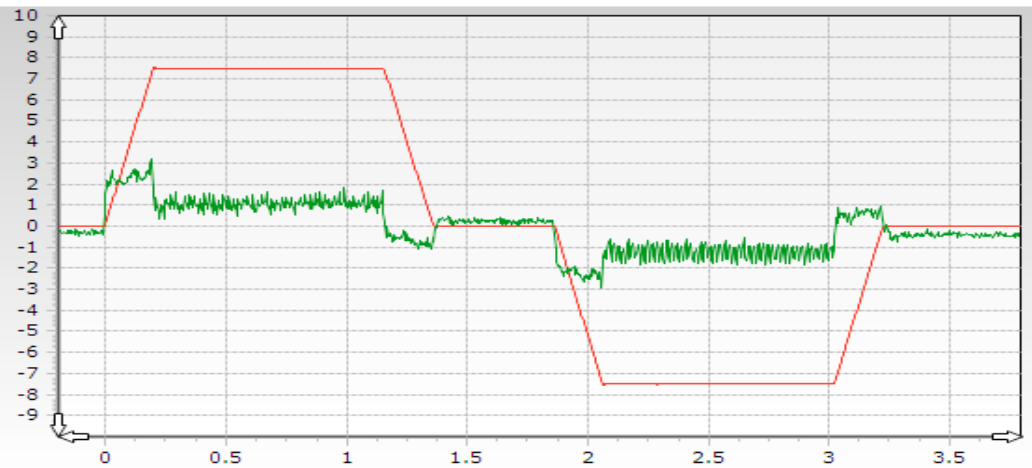
Powerful



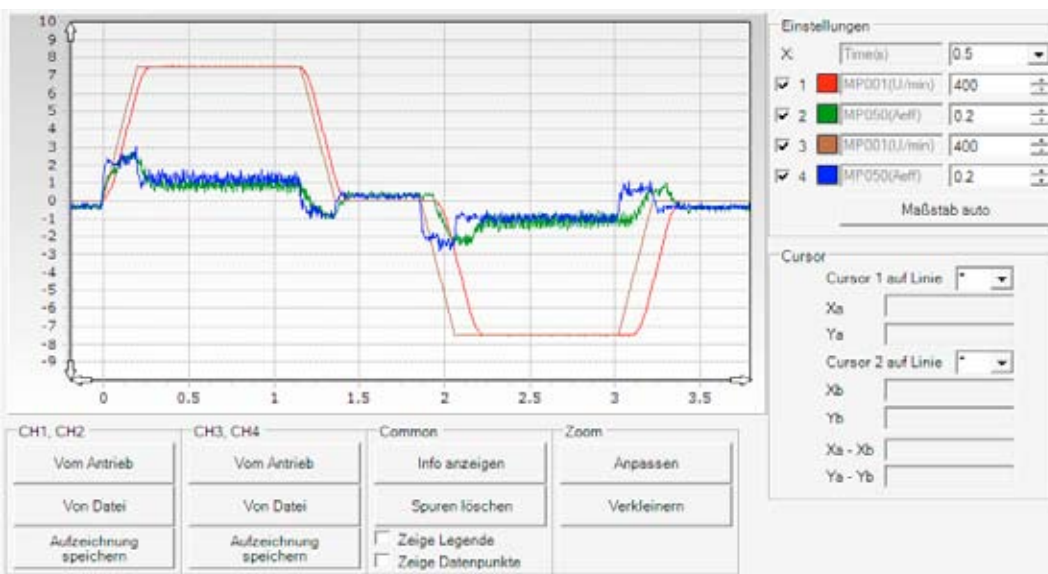
Drive Optimisation with

flexium

In the current Flexium Release 3.3.0.0, the focus is on tools for drive optimisation. The aim here was to provide optimum tools: starting with the graphic editors in the project design phase and encompassing conventional commissioning tools, such as oscilloscopes and frequency analysers for initial commissioning, as well as ballbar tests and the measurement of approach curves and profile precision of finished machines.



Oscilloscope speed and current during rapid motion (top)
Speed and current during rapid motion, different jerk limitation (bottom)



Tasks that previously required a complete machine fleet for their completion can now be performed with one integrated tool – *Flexium-Tools*. The direct access to the internal system data has an additional positive side-effect: the results are even more accurate due to the lack of interference and transformation errors. As no additional devices are required, these kinds of measurements can be repeated with equipment already in use and compared with earlier results. This provides ideal conditions for remote maintenance.

Not only the measurement values, but also the corresponding settings can be simply stored and called up again for reuse – a particularly useful function when making repeat measurements. This makes it simple to obtain comparable measurements, even if they are performed at different times.

Anybody who has worked with a conventional oscilloscope will be able to use the *FlexiumTools* oscilloscope immediately and intuitively. Settings are made for the signal to be measured, the sampling time and the trigger condition and time.

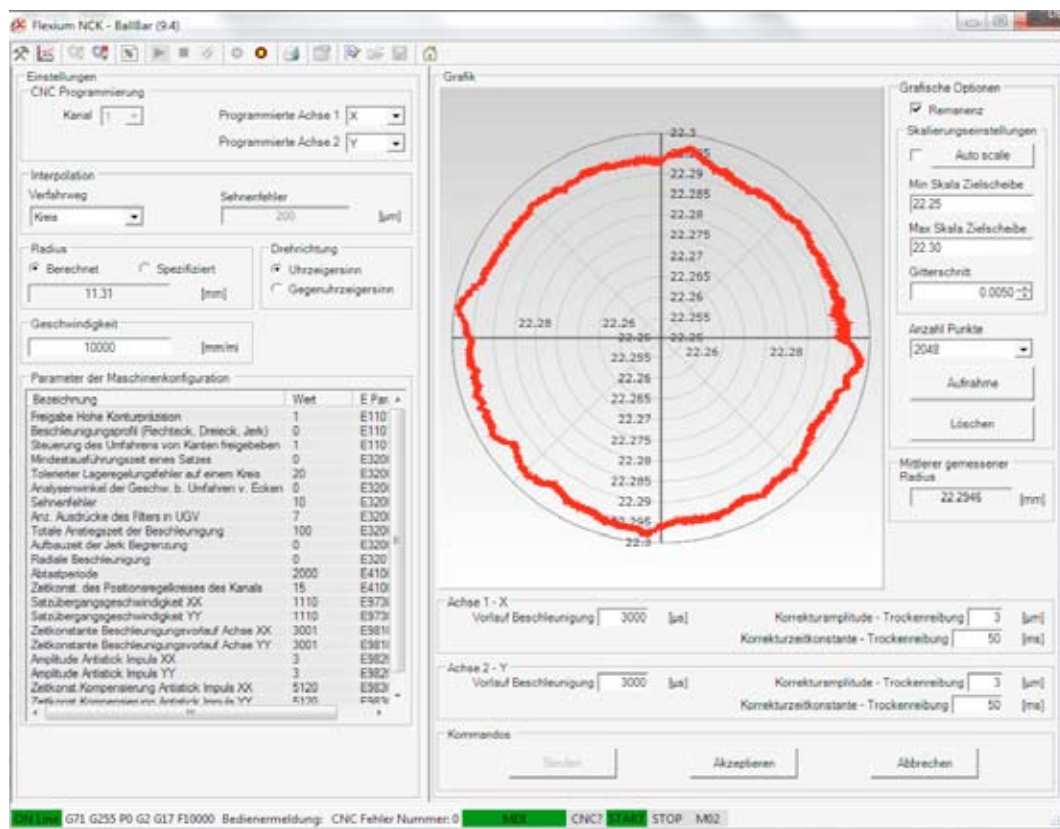
The impression that *position control loop setting*, *ballbar* and *contour precision* seem familiar is not false, these functions are further devel-

opments of the well-known and proven G25X macros from the 1000l Axium series.

The *position control loop setting* enables a quick estimation as to whether the selected amplification of the position control loop (kv) is still permissible or whether it is already too high. In addition, it is also possible to determine the permissible acceleration or overshoots that could be expected on the basis of the start speeds.

The *Ballbar test* gives a good and three-dimensional impression of what happens during transitions between quadrants, i.e. when the direction around an axis is reversed. In addition, the feedforward control coefficients for position control with low lag errors/no lag errors can be determined and set. On the ballbar side, all relevant parameters, including the current value, are displayed and input windows are provided. Here the user can enter modified parameters and observe the effects immediately.

Contour precision displays the deviation between the programmed and measured path in the G17, G18 or G19 levels. As these deviations are very small in comparison to the

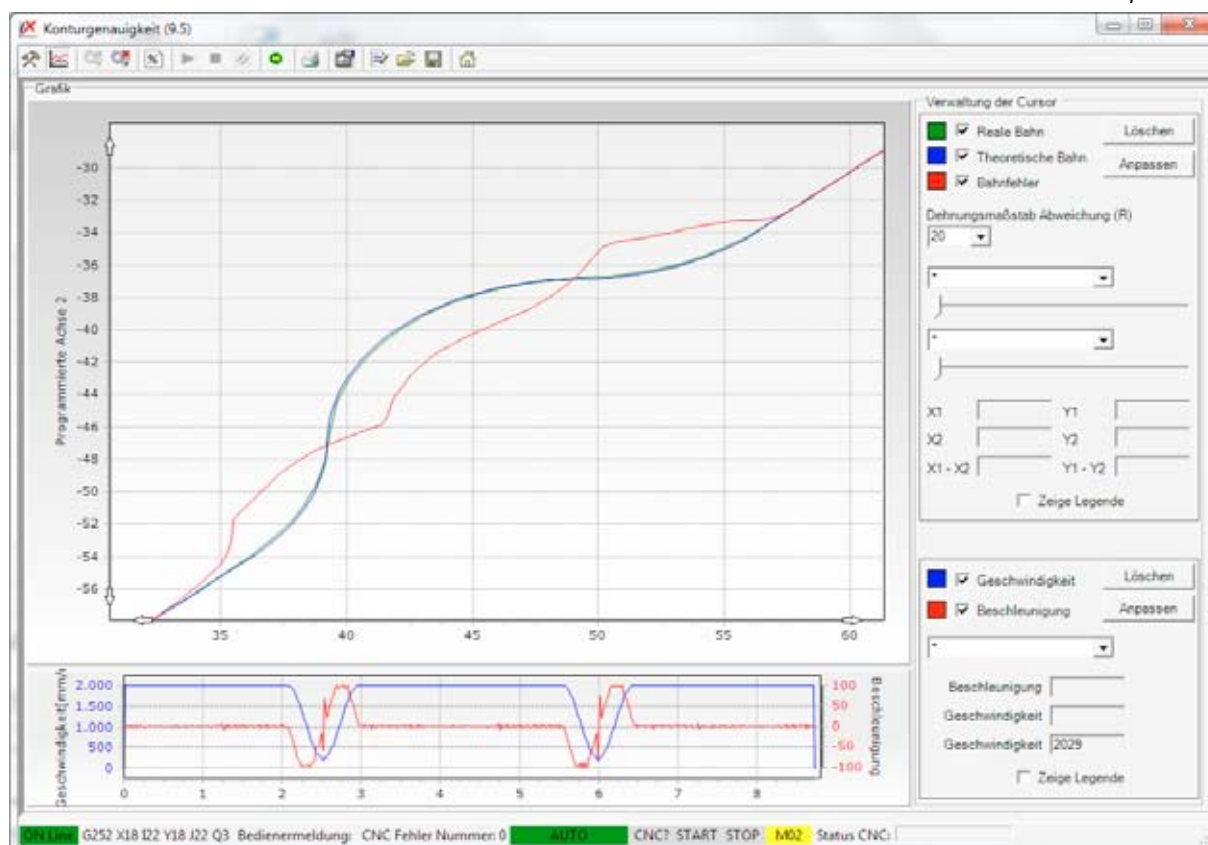


Ballbar test

path length, it is necessary to zoom in transverse to the direction of movement. The deviations can only be seen then. (The same applies to the *ballbar test*). In addition to the target and actual path and the

differences between them, *contour precision* also measures the path speed and path acceleration. These values contain important information for moving around corners and over profile transitions.

Contour precision



Precision



CNC control upgrade of a floor-type mill

The US automation system integrator MasterControls LLC Inc. (MCI) selected NUM's technology for the refurbishment of the CNC system on a large floor-type horizontal boring mill made by Gray.

Destined for a major machinery re-manufacturer operating in the mining industry, MCI and its rebuilder customer performed a very extensive electrical and mechanical rebuild on the mill - even adding a secondary x-axis. The machine had originally been converted from manual to CNC operation back in the 1970s, but the control system was primitive by today's standards, with numerous drawbacks including limited CNC

functionality, a very small memory size, and no networking capability.

By choosing a NUM CNC kernel, MCI has been able to deliver major enhancements to the mill's CNC functionality. These include compatibility with RS274 G-code programming, probing functionality, and an industrial PC front end providing unlimited program storage - as well as networking capability.



Tandem drive pinion assembly is managed by NUM MDLU3 drives



MCI's introduction of a tandem drive arrangement on the x-axis has made a major contribution to the machine's performance and accuracy, increasing torque dramatically for the main axis of the machine - which weighs over 100'000 pounds (>45'000 kg). The two axes are now synchronized in a master-slave arrangement, with the new secondary axis set to lag the primary axis very slightly in order to maintain tension in the geartrain and eliminate backlash. The flexibility of the drives and control software that allowed this configuration was another important reason behind MCI's decision to base the upgrade on NUM technology, as its drives support master-slave architectures. As this was a

Accuracy of the large mill is ensured thru NUM's adaptive axis compensation

A traveling FS151i operator's console, keeps the user close to the tool, while still connected to the factory network



critical element of the project, MCI visited NUM's facility in Naperville, Illinois during the development of the control system to physically test the tandem control, as well as to get the CNC vendor's feedback on MCI's proposed control and programming scheme. Improving the underlying precision and accuracy of the heavily-built mill was a major feature of the control system upgrade, and MCI additionally implemented a table with laser measurements of axis positions to compensate for other variations in the mechanics.

Another key factor in choosing NUM's CNC system was the ability to upgrade the servo drives to advanced digital operation with absolute feedback – enhancing precision a step further. This also eliminated the need for homing moves – freeing the user from having to reference the machine on power loss or after shutdown. All of the control system

engineering and panel building was done off site. When the retrofit control system was complete, MCI took the package to the customer rebuild site and started the installation. This phase was achieved in just three days. After testing and training, the whole machine was then disassembled and shipped to the end user.

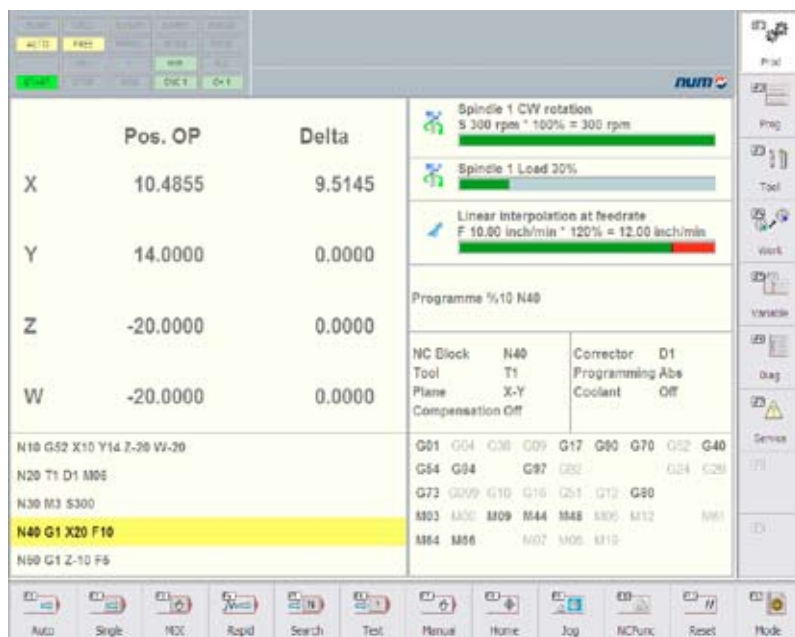
According to Jeff Petry, MCI's Owner & Managing Partner, "We go to our customers with code that has been tested for reliability. The technical support available from NUM, who partner with us on applications like this, makes us comfortable taking on these types of complex projects."

MCI has become well known throughout the United States for automation upgrades on machine tools. The system integrator has over 25 years experience in the business, replacing legacy CNC systems on lathes, mills, grinders, gear hobbers and



other capital equipment. One reason behind MCI's large share of the USA machinery rebuilding market is its willingness to retain existing analog-interfaced servomotor drives on CNC systems – for economy – although this was not a factor in this latest project where the demand was for optimum precision. In turn, MCI relies on close relationships with a number of reliable control system equipment partners, including NUM for CNC applications. If the choice of CNC technology is left to MCI, the system integrator typically chooses NUM because of the programming flexibility the system provides, and the company's willingness to provide in-depth technical support.

"Strong engineering support, and a partnership approach has always been a major element of NUM's business philosophy," adds Steve Schilling, General Manager of NUM Corporation in Naperville. "It's one of the reasons behind the company's success with small to mid-sized machine tool OEMs, and system integrators and upgrade specialists such as MCI."



The CNC-HMI screen gives the user a complete and clear operational view

Evolution

CNC Complete Solutions Worldwide



NUM systems and solutions are used worldwide. Our global network of sales and service locations guarantees professional service from the beginning of a project to its execution and for the complete life cycle of the machine.

**NUM has service centers around the world.
Visit our Website for the current list of locations.**

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