# num information

## JOURNAL FOR CNC–TOTAL SOLUTIONS

**num**
*CNC HighEnd Applications*

# Editorial
## Peter von Rüti, CEO NUM Group

Dear readers,

For the past months, the pandemic has generated unfamiliar and evolving circumstances. Trade fairs on site can only take place regionally, if at all, personal contact is virtual and due to travel restrictions international business trips can only take place with great difficulty or not at all. We had to reorganize communication both internally and externally and make it much more digital than before the pandemic. Throughout this unusual time we have continued to maintain our focus on customer contact and further development of the functions of our CNC system, as well as on NUMROTO and other software solutions and applications developed by NUM. As a result, we emerge from the crisis strengthened and with valuable experience. The slogan "Slow down to speed up" applies particularly well to the past few months. Nevertheless, we are looking forward to implementing exciting projects with you again – personally or virtually.

Combining gear hobbing and gear skiving in one machine? Yes, it's possible! We have expanded our portfolio of CNC solutions for gear manufacturing with Power Skiving. The Power Skiving function provides CNC machine tool manufacturers with the opportunity to build a completely new generation of machines. On the one hand, these machines could hob large gears, and on the other hand they could skive smaller gears and gear teeth whenever tool space is limited – and all on the same axis.

The future belongs to the young: NUM's Taiwan branch has donated a complete CNC hardware and software package to National Formosa University (NFU) in Huwei, Taiwan. The package is part of a larger control upgrade for a precision tool grinding machine in the university's College of Engineering. National Formosa University is ranked among Taiwan's top engineering universities. NUM also donated 20 units of its renowned NUMROTO software for tool grinding and resharpening. The software helps students gain hands-on machine programming skills using 3D simulation techniques at the college's computer workstations.

> "Those who maintain the right focus during the crisis emerge stronger", says Peter von Rüti, CEO NUM Group about the past business year.

NUM Worldwide: with its headquarters in Switzerland, in the beautiful Appenzellerland, NUM places great emphasis on "Swissness" and the highest quality. But NUM also has a presence internationally, with ten of our own branches worldwide and a network of agents, we cover a large area of the service and sales network. Since March 2021, we have added Impuls NDT, based in Moscow, to our agents. Impuls NDT serves as a bridge between NUM and customers in Russia, promoting our service offering and support of NUM products and services in Russia.

We also accompany you around the globe when it comes to projects. In this edition of NUMinformation, our customer reports take you to companies in Taiwan, Italy, India and Germany. With these partners, we have implemented cost- and time-efficient machine automation projects. For example, a NUM CNC system controls the latest production machine at India's largest manufacturer of shoe lasts. Further examples describe CNC grinding machines with the new non-circular grinding functionality, CNC machines for grinding tools and hobs and many more. Please be inspired by our successful projects and talk to us about your future investments.

I wish you much pleasure reading this NUMinformation and hope to be able to welcome you personally at one of the next trade shows.

Peter von Rüti
CEO NUM Group

# Impuls NDT Provides a Bridge between NUM and Russian Customers

**NUM AG has signed a cooperation agreement with the Russian company Impuls NDT.**

Based in Moscow as of March 2021, Impuls NDT has become established in various industrial sectors of the Russian market since 2005. The company's goal as an agent of NUM is to promote NUM products and services on the Russian market and to provide Russian customers with experience of the latest technologies. Impuls NDT also has a branch office in St. Petersburg.

By expanding into Russia, NUM is increasing its local presence as well as its customer-facing sales and service offerings. Moscow is the center for mechanical engineering in Russia, with machine tools and tool-making playing an important role there.
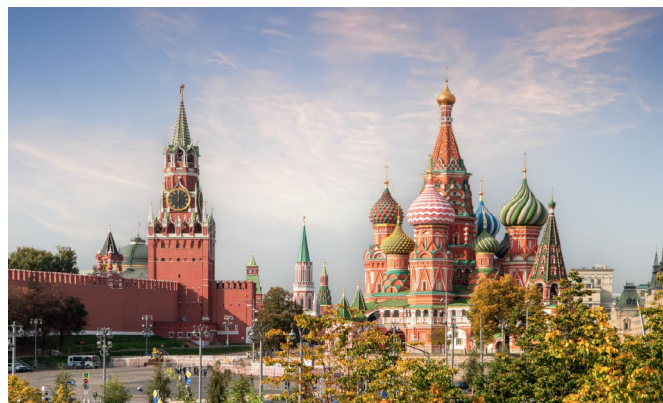


*Moscow, Russia*

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# NUM Event Calendar 2021/2022

**FABTECH 2021**
September 13–16, in Chicago, USA
Hall B, Booth B11029

**EMO 2021**
October 4–9, in Milan, Italy
Hall 7, Booth G26/H27

**EMAF 2021**
December 1–4, in Porto, Portugal

**IMTEX 2022**
January 20–25, in Bangalore, India

**GrindingHub 2022**
May 17–20, in Stuttgart, Germany

# IIoT and Cyber Security

**IIoT (Industrial Internet of Things) or Industry 4.0 is about merging IT technologies with production technologies and creating new, innovative products and solutions. Obviously, there are numerous challenges associated with this: data and machine security, lack of technical standards and, depending on the area of application, the necessary legal framework.**

Many machine and plant manufacturers are hesitant to introduce Industry 4.0 technologies in their own companies. Yet the solutions offered by Industry 4.0 bring the potential to establish new business models through digitization and networking of products and production.

One of the advantages introduced by Industry 4.0 solutions is the ability to adapt production systems, resulting in greater flexibility in the organization of production batches (right up to the production of one-off items), greater simplicity in the management of product variants and consequently greater attention to customer needs. The Industry 4.0 solution approaches make it possible to build production networks that produce efficiently and effectively at low cost.

The technologies for Industry 4.0 solutions are available today. We often receive inquiries from machine manufacturers as to whether NUM offers Industry 4.0 solutions. We can answer this in the affirmative without any problems. NUM has enabled the networking of its controllers since the 1990s. However, networking numerical controls is not enough, the benefits are only obtained by implementing systems for monitoring, supervision, data analysis, coordination, etc., and this is where the machine manufacturer, or end user, comes in.

**What has been/could be realized in a production environment with machines equipped with NUM controls?**
The digital and fast availability of relevant information in production and logistics can simplify processes and workflows. Flexium+ controllers offer this information via various channels: MTConnect, OPC UA and MQTT.

In addition to classic production information such as machine utilization, error messages and current workpiece, there are also early warning systems. These can automatically report when machines are not running error-free, even before there is a noticeable loss of productivity. The NUMmonitor and NUMai tools are available for this purpose. NUMmonitor monitors freely selectable machining parameters. The artificial intelligence NUMai monitors various physical machine signals. Both functions report when they detect irregularities. The system displays this information to the machine operator directly on the machine or sends an e-mail/SMS to his/her smartphone or tablet. The issue can be addressed long before a failure of the machine in a proactive manor. If necessary, logistics and production could be converted to completely paperless processes and lean processes could be supported (lean management is an approach to process optimization in which waste is minimized and processes are harmonized).

Progressively, more and more production environments are being networked to realize the full potential of the Industrial Internet of Things (IIoT) and centrally available data. However cyber criminals are attempting to exploit these Industry 4.0 developments to obtain sensitive data or disrupt production.

Because of the merging of information technology with operational technology (IT and OT), companies are becoming easy targets for attack. For example, by simply opening an email with infected content by an employee in the office, malicious code finds its way into production, which can bring it to a halt.

The 2020 Bitkom (German Association for Information Technology, Telecommunications and New Media) study shows that German businesses are increasingly falling victim to cybercrime. In 2019, at least 75 percent of all companies were affected by data theft, industrial espionage or sabotage. Bitkom calculated a total loss of 205.7 billion euros in 2018 and 2019, which is almost double the previous two years (55 billion euros p.a.).

What security measures need to be taken? On the one hand, of course, technological but also personnel. If employees do not understand the security measures or even see them as an obstacle to their daily work, the best security technology is of no use.

Technologically, for example, password protection should be used on all devices, firewalls and virus scanners. Performing regular backups is also important. Legacy applications, i.e. outdated applications and operating systems, are a challenge. These cannot be provided with the latest security updates.

Special measures in the firewalls are required to secure them, and only selected, predefined accesses to these devices should be possible. Almost all machines belong to this group.

The merging of IT technologies with production technologies, i.e. IIoT or Industry 4.0, is a megatrend in industry. The technical prerequisites for this are in place and data and machine security can be established with suitable measures. It is up to the machine builders or users to combine new applications from this with the support of specialists.

# NUMgear combines Tools and Processes

**Flexium CAM is the framework for NUM's technology HMIs. It is based on HTML for the user interface and incorporates a proprietary program designer for data management and NC program generation.**

On the machine, Flexium CAM – being seamlessly integrated into the Flexium HMI – runs the technology HMIs, receives data entries, performs checks and calculations, and creates the part program that makes the machine do what it is supposed to do. On a push of the green button, the cycle runs the process to manufacture the workpiece.

Now this is where it gets interesting. The flexibility of Flexium CAM enables a combination of tools and processes to be used for technology HMIs like NUMgear.

- You can have one tool using one technology on several gears on a shaft.
- You can combine several tools using one technology on several gears on a shaft.
- You can combine technology processes like dressing and grinding that belong together, such as on a threaded wheel gear grinding machine.
- You can even combine different tools using different technologies on different gears on one machine.

NUMgear makes extensive use of the capabilities of Flexium CAM, in this case enabling the gear industry – and many others if the need arises – to implement flexible, versatile solutions on its machines.

**NUMgear Hobbing**
NUMgear Hobbing provides the opportunity to hob several gears on one shaft, using the same or different hobs on the tool spindle.

The NUMgear Hobbing user interface sports the option to define several gears on one workpiece. All that has to be entered is the data for each gear – module, number of teeth, diameter – and the exact position on the shaft, plus a hobbing process for each gear.

Now if there are several hobs on one spindle, the process is pretty much the same – only you would add a tool definition page to each of the processes. That tool page defines the hob – number of threads, diameter, and pressure angle – and the position of the hob on the tool spindle. The hobbing process will then select the right hob for the gear and move the hob and gear shaft so that each gear on the shaft is hobbed as designed.

**NUMgear TWG (threaded wheel gear grinding)**
For NUMgear TWG, threaded wheel gear grinding, there are two processes using two different tools in different positions. TWG is a grinding process using a grinding spindle. That spindle needs redressing after a predefined number of gears have been ground. To run both dressing and grinding, both processes defined in Flexium CAM are available for the definition of the workflow on the machine.

**NUMgear Hobbing and Skiving**
The next step obviously would be to combine different technologies and different gears on one gear workpiece. We did that by combining Hobbing and Skiving so that both processes can be used on the same gear shaft.



**Now what are the benefits of a complex machine using different tools and technologies on one gear?**
Gearboxes are getting smaller and requirements on noise emission and torque transmission are getting bigger. Gears have to be set into the gearbox more tightly than ever and the requirements on the precision of the adjustment of gears on the shaft are rising. However, packing more gears onto one shaft will leave less space between gears and the hob will collide with the next or the next bigger gear on the shaft.

Today you would manufacture each gear on a dedicated machine and then fix them to the shaft. But production is so much easier if you just omit that step. And this exactly is where the combined processes come into play, offering hobbing and skiving on one shaft without the need to change machines or to assemble the gears on the shaft.

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# NUM AutoTuner

**NUM has re-invented the auto tuning approach for machines' axes and spindles.**

Until now, most auto tuning procedures include adjustments based on a predefined speed/position stimulus, using suggested control loop parameter gains.

With this approach, resonances are only occasionally defected and filtered.

NUM proposes a different methodology; the machine's operator just needs to run an ISO part program (almost any part program is acceptable) which moves the axis to be tuned, and an observer starts to estimate different physical variables such as axis total inertia, friction in both directions, vertical loads, if any, and resonances.

Based on these estimations, the NUM AutoTuner function proposes the proportional and integral speed loop gains (suitable for the drive performance and switching frequency in use); the encoder low pass filter; the maximum position loop gain and the most critical vibration mode.

Without the need for a specific speed/position stimulus, NUM AutoTuner can also be used during normal machining and it's suitable for optimizing axes which are subject to changes of condition. For example, the size and weight of the workpiece can vary widely which significantly changes the axes' inertia. Using the NUM AutoTuner, these variances can quickly be identified and adapted via control loop adjustments.

AutoTuner is fully integrated in Flexium Tools, the unique development environment for the entire Flexium$^+$ system. Flexium Tools allows users to program the PLC, the safety application, to configure the CNC and drives and to optimize the whole system by means of various Instruments (the AutoTuner is one of these Instruments).

Most mechanical systems have inherent vibration modes which can generate resonances. In addition to the very powerful Frequency Analyser function available in Flexium Tools, AutoTuner incorporates a dedicated function for simplifying resonance detection and analysis; the characteristic parameters of the main resonance are shown, so it becomes easy to set appropriate counteracting measures (for example notch filters).

AutoTuner can optimize any type of motor: rotary synchronous, rotary asynchronous, linear, torque motors, ... including vertical axes, hydraulically balanced axes and spindles.
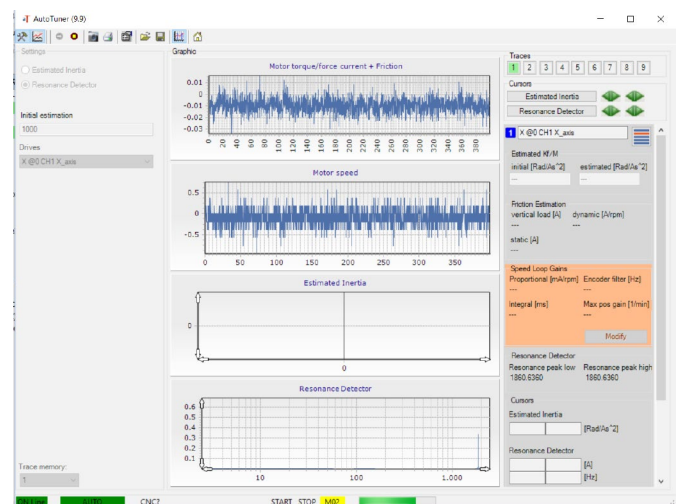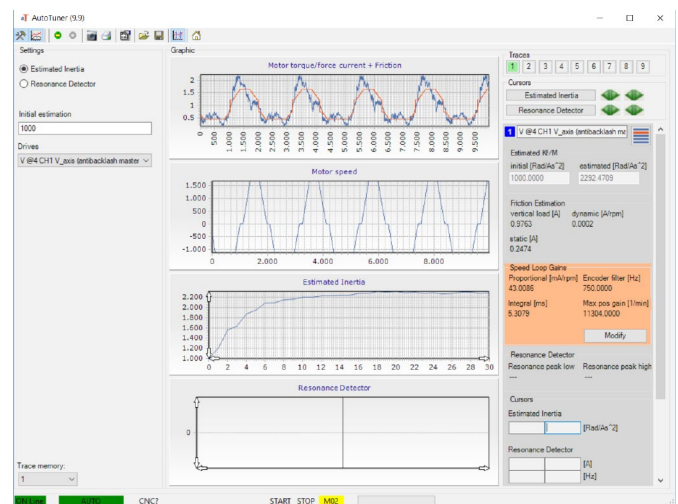
# NUM Adds Power Skiving to its Portfolio of Gear Production CNC Solutions

**CNC specialist NUM has further extended the functionality of its renowned NUMgear family of gear production technology with the addition of an extremely flexible software option for power skiving.**

NUM's new power skiving option provides the enabling technology for CNC machine tool companies to address a key market opportunity in the nascent compact gearbox manufacturing industry. It is now possible to create an entirely new generation of gear production automation that offers combined hobbing and skiving capabilities on a single machine.

Gear manufacturers currently employ a variety of machining processes, including hobbing, shaping, broaching and grinding. To a large extent, the processes that are used are dictated by the type and size of the gears and splines being produced. Hobbing is ideal for external gears, while shaping and broaching are best suited to the production of internal gears – but the latter is only really practicable with small gears. Power skiving, on the other hand, is potentially a much faster and more efficient way of creating external and internal gears of any size.

However, despite being developed and patented more than 100 years ago, it is only recently, with the advent of multi-axis machine tools capable of precision high-speed synchronisation, that the technique of power skiving has become a practicable proposition for industrial-scale use.

Based on NUM's high performance Flexium$^+$ CNC platform, the new power skiving solution forms the latest addition to the company's NUMgear suite of gear production software. Originally developed specifically for gear hobbing applications, NUMgear is continually enhanced to meet industrial requirements and nowadays offers solutions for a broad range of gear manufacturing processes; it is used by many leading manufacturers of gear production machines.
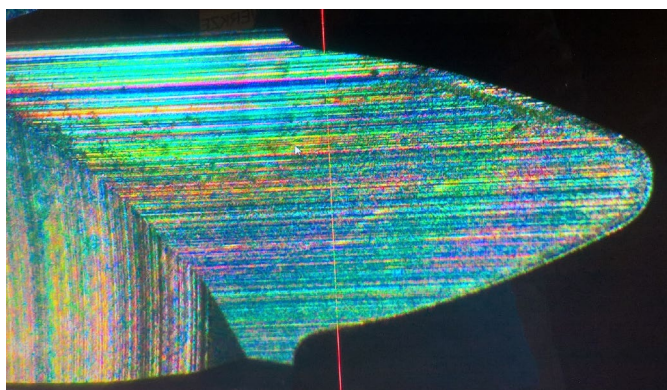


*Tooth of the skiving tool under the microscope*

The new power skiving software capitalises on the speed and precision of NUM's advanced multi-level electronic gearbox (MLEGB). This very high performance unit is capable of unprecedented speed and accuracy – it can handle up to 25,000 rpm on the leading axis, and uses look-ahead algorithms to predict both the speed and the acceleration of axes, in order to minimise synchronisation time.

The characteristics of the MLEGB are user-defined in the part program. Any axis can be nominated as leading or following, linear or rotary, and the ratio between the leading and following axes can be controlled by a user-defined fixed parameter or a dynamic machine-cycle variable (curve table). Flexibility is even further enhanced by the fact that multiple MLEGBs can be cascaded, a fol-

lowing axis in a dynamic gearbox can be used as a leading axis in another MLEGB, and either the leading or following axis in an EGB can be real or virtual.

A single multi-role CNC machine tool that offers gear manufacturers the ability to hob large gears and to power skive smaller gears on one shaft whenever tool space is constricted – such as in a compact gearbox – would almost certainly enjoy rapid industry take-up. Thanks to NUM, the CNC control technology, together with the necessary precision servomotors and drives, is now a reality.

NUM's new power skiving software option can be installed and used on any Flexium$^+$ CNC system running Flexium software version 4.1.00.00 or higher.
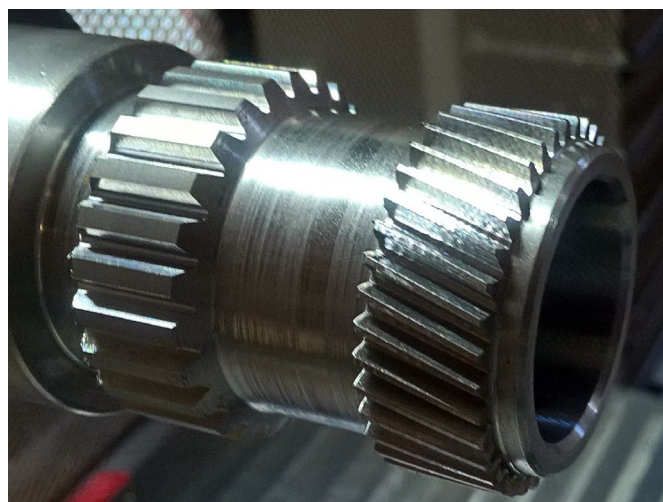


*Helical hobbed, straight gear skived*

# Innovative AI Software Facilitates Condition Monitoring of CNC Machine Tools

**NUM has launched innovative artificial intelligence software that provides CNC machine tool users with highly cost-effective condition monitoring capabilities.**

Compatible with all of NUM's latest-generation Flexium$^+$ CNC systems, the NUMai software package is a complete, fully integrated solution for CNC machine tools – it does not require any additional sensors, and runs on the same industrial PC as the CNC system's HMI (human-machine interface).

The NUMai software can be utilized whether the machine is new or old. During a normal machine production, typically over a number of hours, the software initially acquires all pertinent operating data. Ideally, a diversity of part programs is run, involving a variety of different machining conditions, in order to ensure that the data is as comprehensive and reliable as possible.
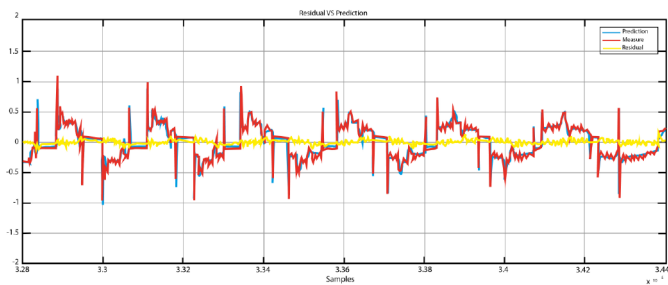
The collected data is used to teach a neural network so that any deviation from the "good" machine behaviour and performance can



*This schematic shows the neural network's prediction of a variable (blue) and the measured value of the variable (red). The residual error is shown in yellow*

then be detected and predicted; a suitable PC program for subsequent online performance monitoring and diagnostic purposes is generated automatically.

During the software's development, NUM beta tested the technology on a CNC milling machine equipped with three axes and a spindle, which required a neural network comprising 36 neurons with three hidden layers. In this particular instance, 396 parameters needed their values to be accurately defined; this required the acquisition of

more than 2 million "known good" data points and 300 iterations of the teaching phase, which took about four hours per axis.

NUMai condition monitoring software capitalises on the inherent flexibility of NUM's latest-generation Flexium$^+$ CNC platform. As standard, every Flexium$^+$ CNC system includes a PC which can handle data from the servo drives' measurement points, a PLC that has direct access to machine parameters, and an NCK oscilloscope feature capable of reading values in real-time. All system communications are handled by FXServer, using fast real-time Ethernet (RTE) networking.

During everyday use in the production environment, NUMai software runs in the background on the industrial PC that forms part of the machine tool's CNC system, continuously monitoring and evaluating the machine's performance. Any discrepancy or deviation beyond user-defined thresholds is notified to the PLC, which decides what action should be taken – from a simple advisory message to an emergency disengagement.
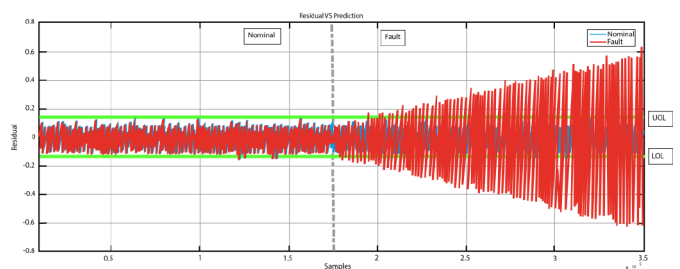
The new NUMai condition monitoring software option can be installed and used on any Flexium$^+$ CNC system running NUM's Flexium software version 4.1.10.10 or higher.



*This schematic shows the increase in residual error of an estimated variable after a fault condition, resulting in a warning being set*

# Flexium CAM Profile

**CAD/CAM systems are used for the design of complex profiles. However, there is always a need for simpler 2D geometries. For example, the contour of a part to be turned or ground or the geometry of a milled part as well as the profile of a profile grinding wheel or a non-circular shape (cam) may be required. A new tool from NUM, called Flexium CAM Profil, makes the 2D profile design very easy. It belongs to the Flexium CAM family, which also includes special technological HMIs for milling, grinding and gear manufacturing.**

The tool is divided into the following contexts:

- File
- Profile view
- Profile editor
- postprocessor
- Settings

In the "Profile Editor" context, the user creates the geometry by means of graphical inputs. A wide range of functions is available for this purpose. The basic profile is predefined by means of straight lines and circle segments. Non-tangential transitions can then be provided with chamfers or circles. Profiles can be rotated, mirrored and moved. The design work is supported by means of zoom and measurement functions.

Profiles can also be imported in the "File" context and thus do not have to be created by the user. The data is read in dxf format or by point lists.
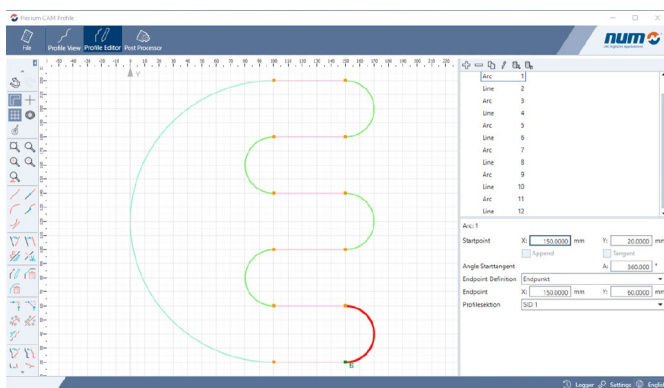


The profile projects are also opened or saved in this context.

Sectors, or groupings, can be assigned to an individual profile element or a sequence of elements. Later in the "profile view" the sector can be assigned various technological values, such as a feed rate, tool speeds, and others.
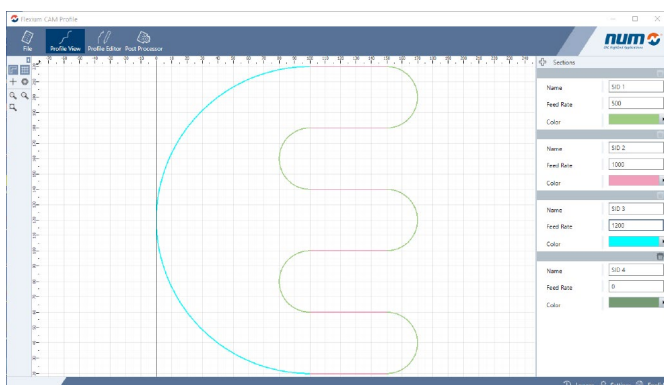


Finally, a profile is converted, together with the technological values, to an NC program. The "Postprocessor" context is used for this purpose. Here the user can add a program number and comments to the NC program. The resulting part program is displayed. It can be saved or transmitted directly to the Flexium NCK (if a connection is available).
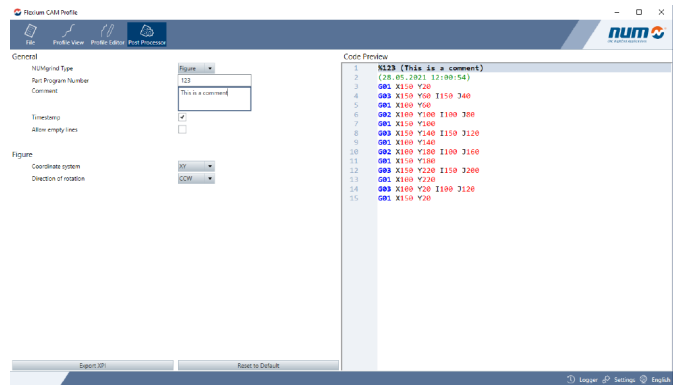


Depending on the technology area of application of the Flexium CAM Profile Tool, different NC programs are generated. A program with a milling geometry is slightly different from a program containing a turning, cylindrical or non-circular grinding or grinding wheel profile. The selection of the desired technology is made in the "Settings" context. The OEM can also record specific NC program sections here, which are used when generating an NC program.

Other basic settings, such as the display language, are also defined in this context.

Flexium CAM Profile is mostly run directly on the machine, but can also be used in the office.

With Flexium CAM Profile, the creation of 2D geometries within the Flexium world is significantly simplified, bringing time saving value to the customer.
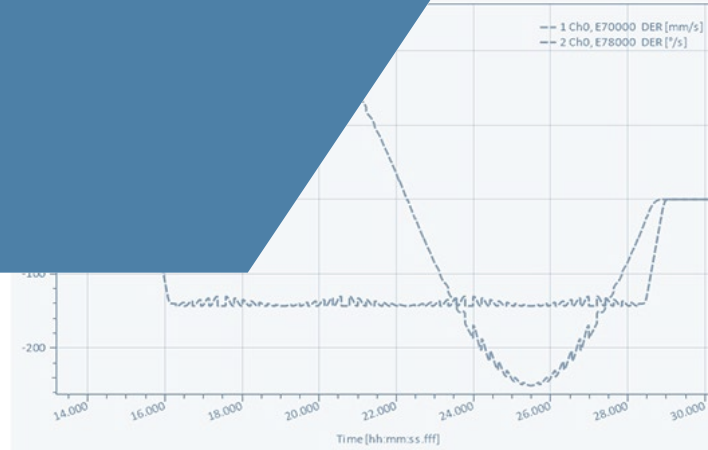
# Optimization of 5-Axis Machining

**The advantages of orienting the tool in relation to the machining surface have been consolidated in the last few years, and five-axis machining nowadays offers the best solution for many end-users. Machine tool builders are continuously developing different kinematic configurations to take advantage of this technology, helping end-users to further improve the performance of their machining operations.**

Five-axis machining would have not been so successful without the introduction of the RTCP (Rotation Tool Center Point) function. NUM was a forerunner in the development of RTCP, and introduced it decades ago. Furthermore, we continually enhance the RTCP function, to address machine builders' and end-users' changing needs.

Machine tool builders can benefit from twenty-four predefined kinematic configurations that are already present in the system.

If a kinematic type is missing, our team is available to develop and add the necessary machine configuration.

The Flexium⁺ system is able to manage multiple kinematics in the same machine, for example, when different milling heads are needed.

RTCP functions are enabled by NUM ISO code G151, and by making use of different attributes the basic function can be activated with variants.

It's possible to enable the RTCP function with an ICS (inclined coordinate system) with respect Machine Coordinate System. It's also possible to enable the RTCP function with an ICS by teaching to a known coordinate inside the inclined frame. In either case, the CNC will calculate the mechanical offset to ensure that the tool center point is always in touch with the defined surface while the rotary axes are moving.

End-users also appreciate the ability to activate RTCP by the actual position of the rotary axes. The command G151 R1 reads the rotary axes' positions and activates the RTCP function, in a quick and user-friendly manner.





**Enable a tool coordinates system computed from the current tool orientation**

**G151 R1: Tool frame activation for a tool retraction**
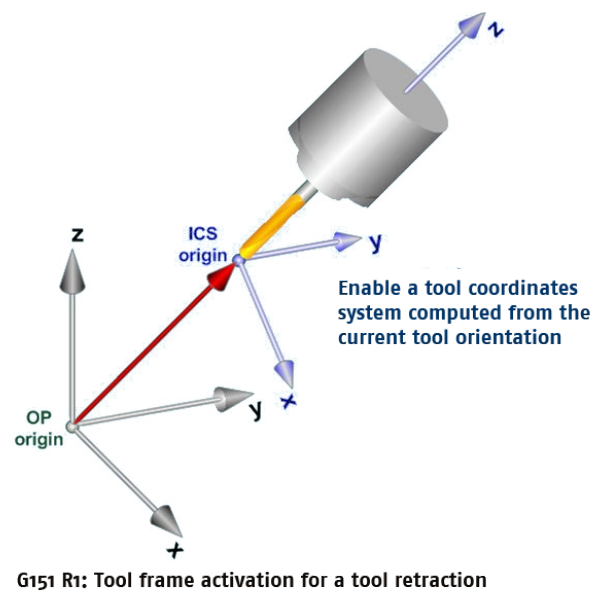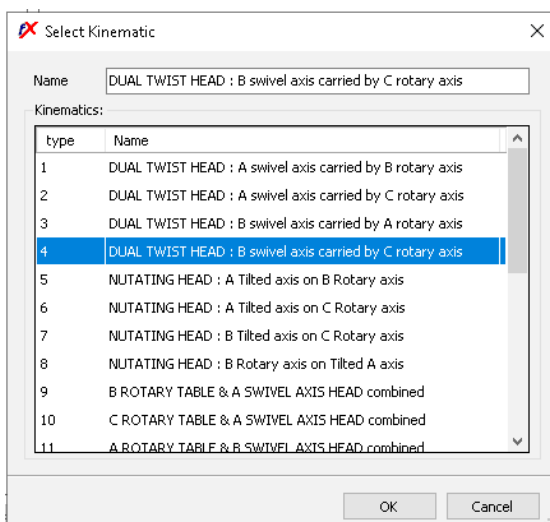
Programming 5-axis machines is a task that should not be underestimated. Often the rotary axes are programmed directly with their angular position. This has the advantage that the position of the machining head can be imagined when viewing the part program. The disadvantage, however, is that the part program depends on the kinematics of the machine, and the part program cannot be transferred to another 5-axis machine without modification. To make the part-program independent from the machine kinematics, you can use tool vector programming; the direction of the tool is then determined by the vectors' components along the X,Y and Z axes

Under certain circumstances, the alignment of the work pieces to be processed on the machine can be very complex. In such cases, to increase productivity, instead of moving the workpieces, the Flexium$^+$ CNC offers the ability to compensate the positioning deviations (including angles) by means of corresponding correction values. The workpiece remains misaligned, but the CNC knows such deviations and compensates for them by software.



ICS: Inclined Coordinate System (origin in Opi)
BCS: Balanced Coordinate System (origin in O$_{wpc}$)
MCS: Machine Coordinate System (origin in OM)
WCS: Workpiece Coordinate System (origin in OP)
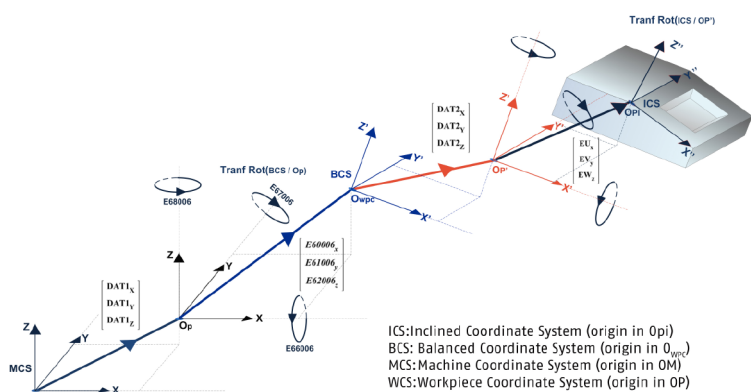
The CNC control provides a special HMI page for this purpose, where the corresponding correction values can be entered. The coordinate system resulting from the shifts and rotations is called a "Balanced Coordinate System" (or BCS) and the compensation function is called 3DWPC (3D workpiece compensation).

End-users often meet another critical issue: part programs generated by CAD/CAM systems comprise small G01 segments and these segments can be distributed inhomogeneously (especially for rotary axes' movements). The result is speed discontinuity which has a negative effect on surface quality.
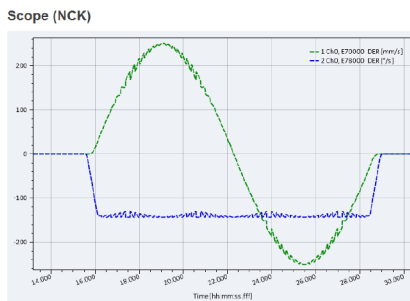


Without constant speed function
Green: Linear axis' speed
Blue: Rotary axis' speed

New algorithms to maintain constant speed at pivot points during the movement of rotary axes allow these discontinuities to be smoothed, resulting in an improved surface.
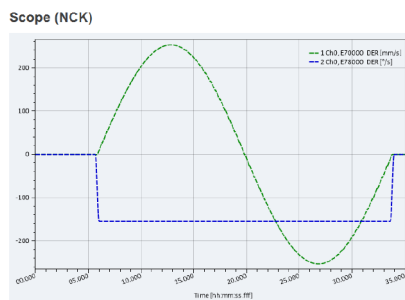


With constant speed function
Green: Linear axis' speed
Blue: Rotary axis' speed

As well as many small "noisy" G01 segments, another issue that often arises concerns sharp variations of axes' speed being programmed in the part program. These speed variations can generate strong vibrations and again, result in poor surface quality. The use of smoothing filters can provide a considerable improvement in surface quality.
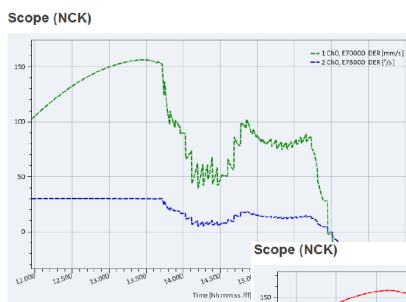


Without Filters
Green: Linear axis' speed
Blue: Rotary axis' speed
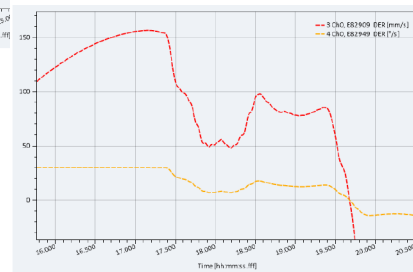


With Filters
Red: Linear axis' speed with smoothing filters
Orange: Rotary axis' speed with smoothing filters

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# Brake Test Function

**As a result of automation, demand for increased production and reduced operator physical effort, the safety-related part of control systems (SRP/CS) of machines play an increasing role in the achievement of overall machine safety.**

There are many situations on machines where the SRP/CS is employed as part of safety measures that have been provided to achieve risk reduction.

In many machines a servo motor brake can be used to prevent a vertical axis from falling. In a typical scenario, when the guard door opens, system might engage the brake to stop hazardous machine operation. A hazardous machine operation can simply be a vertical axis which falls because its weight is not balanced and/or because its brake does not work properly.

A safety certified servomotor brake, along with the SBC (Safe Brake Control) function can be implemented by using the NUMSafe PLC and NUMSafe I/Os. For various reasons, Machine builders often due not have the possibility to integrate safe brakes; in this case, it is necessary to introduce a redundancy and the servo motor's torque can serve as redundant channel (one channel is the axis's brake the second channel is the motor torque).

NUM provides a diagnostic function, called Brake Test, which automatically checks if the axis's brake is good enough to hold the axis in position. If the brake is not good enough the NUMDrive X keeps the motor enabled until a safe position is reached.

The brake test function is triggered by the PLC application; once the test is triggered, the Flexium$^+$ system performs it autonomously. Flexium NCK informs the PLC if the test is passed or not. As previously explained, in case the test is not passed, the drive keep the axis enabled and the OEM application will need to move the axis to a safe position before removing the motor's torque.

During the machine's risk analysis, these types of hazardous situations need to identified and a risk reduction process must be carried out. In the case of vertical axes, which can fall, usually, two measures should be taken: use a safety certified servomotor brake and implement a safe brake control (SBC).

# G732 Surface Quality Performance

**CAD/CAM systems are now the most important and commonly used means of handling CNC programming. Machining is becoming more and more demanding. The increasing use of complex structural parts in industries like aeronautics and aerospace, and of parts designed for ergonomic improvement or aesthetic appeal – such as corner–free shapes using different types of molds – is driving up the complexity of the surfaces and therefore of the part programs.**

The design of these parts is typically done with a 3D CAD system, and the part program is subsequently generated using a CAM post–processor.

The ability to simulate the entire machining process of such complex parts using Flexium 3D is of considerable benefit to end users – it saves time and helps to avoid mistakes.

To match this trend, the Flexium$^+$ CNC system keeps evolving and improving the ability to support and interact with CAD/CAM systems. One side effect is that even more parameters, and of higher com-

plexity, must now be handled by users. Chordal error, point density, acceleration, look ahead, tolerance, filters etc., must all be managed to obtain the best machining results.

With the new G732 function, NUM simplifies parameter optimization and computes pre–settings for roughing and finishing, with adjustable smoothing levels.

Machine tool builders can adapt and extend the G732 function with more pre–setting, or they can customize the standard values.

End–users can use the G732 function with default parameters or they can optimize the cycle with more details:

| Syntax | Parameters | |
|---|---|---|
| **G732 ET***Type* <br><br> (minimal set, default values) | *Type:* <br> –1 = Reset <br> 0 = Fast machining, ideal for roughing <br> 1 = Accurate, ideal for finishing | |
| **G732 ET***Type* **ER***Tolerance* | *Tolerance:* <br> Acceptable profile tolerance in millimeters <br> Ex: G732 ET0 ER0.02 (Fast with 0.02 mm tolerance) | |
| **G732 ET***Type* **EC***ChordalError* | *ChordalError:* <br> Small chordal error is chosen to guarantee high accuracy. Small chordal error will generate a large volume of data. |  <br> Big chordal error <br> Small chordal error |
| **G732 ET***Type* **EL***LengthOfSegments* | *LengthOfSegments:* <br> The distance between points is a usual CAM parameter; many points means that small segment lengths will generate a very accurate curve but the CNC could reduce the feed due to too many points in a small path (limit due to block processing times). <br> Note: Balancing ET and EL (segment lengths) provides the best compromises in terms of machining time and accuracy |  <br> Distance (EL) |
| **G732 ET***Type* **EF***Filter* | *Filter:* <br> The optional filter can be used to smooth the surface and reduce the mechanical shock. <br><br> Green : *Linear axis' speed* <br> Blue : *Rotary axis' speed* <br> Red : *Linear axis' speed with smoothing filters* <br> Orange : *Rotary axis' speed with smoothing filters* |  |
| **Note** | **ET mandatory parameter** <br> **ER** optional <br> **EL** optional <br> **EF** optional <br><br> Optional parameters combination is freely definable. | |

G732 makes the machine operator's job easier by reducing the time required to obtain an excellent machining result!

num

# CTMS2912 NUMSafe Module with 2 Safe Digital Outputs, 24V DC 2A

**The NUMSafe product family has been extended by the CTMS2912 module.**

This offers two fail-safe outputs that can each be loaded with up to 2 A. The outputs of the module are controlled by a NUMSafe PLC (e.g. CTMP6900 or CTMP1960) via FSoE (Fail Safe over EtherCAT). Please note that, to correctly handle this new safety device, the minimum software version needed for the Flexium$^+$ system is 4.1.30.0. The CTM2912 also features safety parameters that allow the functionality to be specifically adapted to the respective safety-related requirements. For example, testing of the outputs can be configured in fine increments in order to be able to detect cross-circuits and react appropriately. Like all previous CTM terminals, the CTMS2912 can be mounted within an EtherCAT Terminal line up. With a dual-channel implementation, CTMS2912 meets the requirements of IEC 61508 SIL 3, DIN EN ISO 13849-1:2006 (Cat 4, PL e).

Special features:

- 2 safe outputs with 2 A capability
- fine incremental configuration of the test pulses of the individual output channels
- standard outputs can be activated with automatic ANDing with a safe output signal
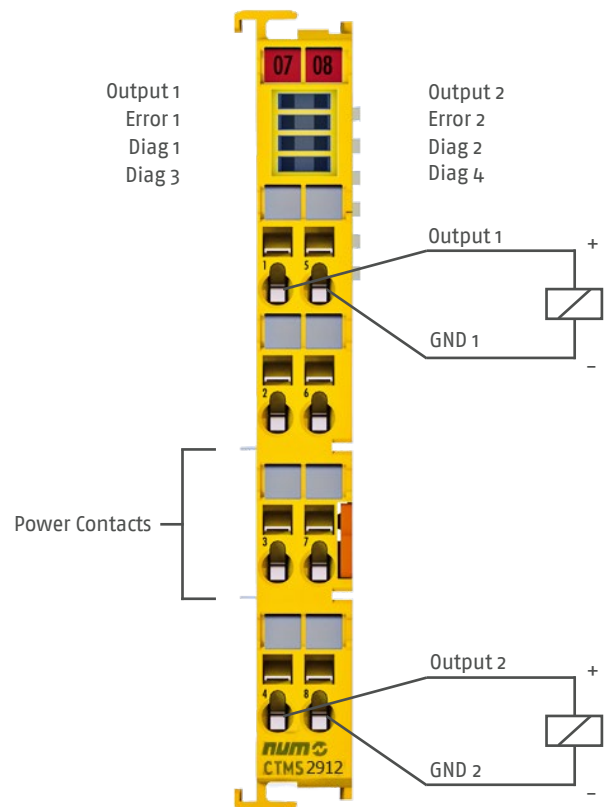
# NUM – 60 Years of CNC Development

**NUM was founded in France back in 1961, as a specialist CNC development group within the former Telemecanique company. Since then, that small group of people has steadily grown to become NUM AG – an industry-renowned provider of high-end CNC solutions. Today the company's headquarters are in Teufen, Switzerland, and it has 10 subsidiaries worldwide. This year, NUM proudly celebrates 60 years of CNC development.**
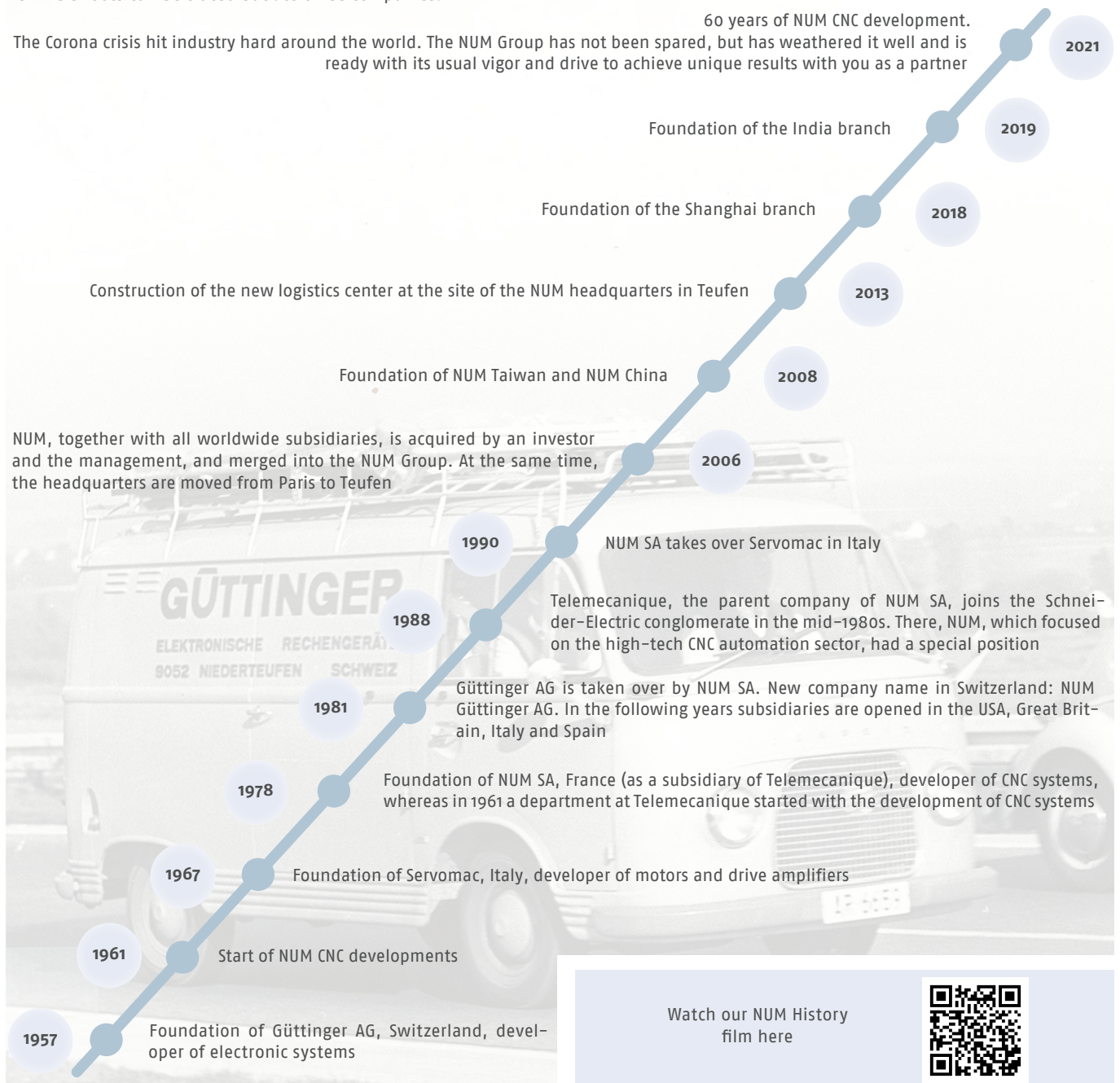
"A lot has changed since the early days – the economy, the people, the industry", says Peter von Rüti, CEO NUM AG. "However, we have always maintained one thing: our passion for new, exciting technologies, not shying away from new challenges, the courage to try something new, and especially to realize excellent unique selling propositions together with our partners." Peter von Rüti has now been CEO of the NUM Group for more than 15 years and says: "An anniversary like this is a fitting occasion to say thank you to customers, partners, employees and investors. It is a great pleasure to be able to work together with such motivated and competent people worldwide."

NUM AG's roots can be traced back to three companies:

The Corona crisis hit industry hard around the world. The NUM Group has not been spared, but has weathered it well and is ready with its usual vigor and drive to achieve unique results with you as a partner

**1961 – 2021**

**60** years of CNC

**2021** — 60 years of NUM CNC development.

**2019** — Foundation of the India branch

**2018** — Foundation of the Shanghai branch

**2013** — Construction of the new logistics center at the site of the NUM headquarters in Teufen

**2008** — Foundation of NUM Taiwan and NUM China

**2006** — NUM, together with all worldwide subsidiaries, is acquired by an investor and the management, and merged into the NUM Group. At the same time, the headquarters are moved from Paris to Teufen

**1990** — NUM SA takes over Servomac in Italy

**1988** — Telemecanique, the parent company of NUM SA, joins the Schneider-Electric conglomerate in the mid-1980s. There, NUM, which focused on the high-tech CNC automation sector, had a special position

**1981** — Güttinger AG is taken over by NUM SA. New company name in Switzerland: NUM Güttinger AG. In the following years subsidiaries are opened in the USA, Great Britain, Italy and Spain

**1978** — Foundation of NUM SA, France (as a subsidiary of Telemecanique), developer of CNC systems, whereas in 1961 a department at Telemecanique started with the development of CNC systems

**1967** — Foundation of Servomac, Italy, developer of motors and drive amplifiers

**1961** — Start of NUM CNC developments

**1957** — Foundation of Güttinger AG, Switzerland, developer of electronic systems

Watch our NUM History film here

# NUM Donates Advanced CNC System to Taiwan's National Formosa University



**NUM's Taiwan subsidiary has donated a complete CNC hardware and software package to the National Formosa University in Huwei. The package forms part of a major control upgrade to one of two precision tool grinding machines in the university's College of Engineering.**

The upgrade project is being handled by the machine's manufacturer, Top Work – one of Taiwan's leading producers of tool grinding machines. Based in Taichung City, and only a few miles away from NUM's Taiwan facility, Top Work has collaborated with NUM on numerous CNC projects over the past few years and nowadays incorporates NUMROTO software in many of its tool grinding machines.

The National Formosa University (NFU) is ranked one of Taiwan's best technological universities. It has four colleges and 19 departments, and runs 18 master's degree and two doctoral degree programmes. Over 10,000 students are currently enrolled at the university.

Postgraduate students pursuing master's degrees in engineering have the opportunity to gain first-hand experience of modern tool manufacturing technology. The university's engineering facilities include among others 3- and 5-axis milling machines, two Top Work tool grinding machines, and a Zoller genius 3 universal measuring machine.

According to Adrian Kiener, CSO Asia NUM, "We have links with a number of universities in Taiwan, and are pleased to support them whenever practicable. In this case, we became aware that the control software on one of the NFU's original Top Work grinding machines was starting to impose limitations, so we decided to donate a complete CNC system." The system is comprimised of NUM's latest-generation Flexium$^+$ 68 CNC hardware and software, together with a number of the company's high performance digital servomotors.



*NUM has donated an advanced CNC system to Taiwan's National Formosa University. Photo shows (Left to right): Dr. Neil Chen, Top Work's AGM, who also teaches at the university, Oscar Cheng, Top Work's GM, Wen-Ching Wong from Spindlex Technologies Co., Ltd, who donated the machine's spindle, Tony Shu, President of Top Work, and Adrian Kiener, CSO Asia NUM*

NUM has also donated 20 copies of its renowned NUMROTO tool manufacturing and re-sharpening software, to help students acquire hands-on machine programming skills using 3D simulation techniques.

Founded in 2008, NUM Taiwan Ltd. is a subsidiary of NUM and is based in Taichung, where many machine factories are located. NUM Taiwan Ltd. is responsible for businesses throughout south-east Asia, Korea and Japan, including CNC project development, after-sales service, education, and training.



*NUM has donated an advanced CNC system to Taiwan's National Formosa University. Photo shows the new nameplate on the classroom*



*Photo shows the President of the university, Dr. Wen-Yuh Jywe (left) and Adrian Kiener (right), CSO Asia NUM, holding the certificate during the formal handover ceremony*

num

# Long-Standing Collaboration Spanning All Generations of NUM Systems



**Entering Meccanica Ponte Chiese is like entering a museum dedicated to NUM. The first numerical control system is around thirty years old, while the most recent belongs to the latest generation. Allowing you to see and feel the technological evolution not only in the field of numerical control, but also in its direct application in the production environment. The partnership between NUM and Meccanica Ponte Chiese is a long-standing one, which has been consolidated over time. For example, consider the case of a recent important investment made by the company to replace the CNC Fanuc 31i CNC system in a legacy MCM machine with a Flexium⁺ 68 from NUM.**

Let's start from the beginning.
Meccanica Ponte Chiese was founded in 1973 by Giovanni Ferraboli, but it was in 1978 that it took the name it still bears today. Headquartered in Prevalle, within the province of Brescia, the company specializes in contract machining for a wide range of sectors: agriculture, earthmoving, wind power, shipbuilding, textiles, energy and so on. The founder Giovanni Ferraboli is still at the helm and has been supported for years by his children Gianluca, Mirko and Monica. The company's production facility covers an area of 10 thousand square meters, of which more than 6 thousand are covered, and houses eleven MCM machining centers. All equipped with NUM numerical control, and a metrology room with three quality control machines, responsible for checking and certifying every piece produced by Meccanica Ponte Chiese before delivery.

The machine centers at Meccanica Ponte Chiese's plant operate 24 hours a day, 7 days a week all networked and managed by a central system aimed at optimizing production precesses. "The first MCM machining center installed in 1988 was already equipped with NUM numerical controls, specifically a NUM 560", explains Gianluca Ferraboli, who is now head of the production department. "In 1994, we bought the second machining center, also MCM and again equipped with NUM CNCs, but in this case with a NUM 760. Then, every two or three years, we would make further investments to complete the existing equipment or introduce new ones, and thus be able to respond to market requirements in the best possible way. At the Meccanica Ponte Chiese facility, we started with the first two generations of NUM's analogue systems – the 760 CNCs, followed by the 1060s – and then moved on to digital systems – first the 1050s, then the Axiums and finally the Flexiums."

The well-thought-out strategy pursued by Meccanica Ponte Chiese and based on the decision to implement only MCM machines equipped with NUM numerical control in its plant stems from very specific requirements.

"First of all", explains Gianluca Ferraboli, "the simplicity of programming, which – in our case – is mostly done on board the machine; by now, each of our operators is very familiar with NUM's CNC development environment, which greatly reduces the time required for this operation. The new Flexium⁺ 68 release has also further improved the usability of the system through a more user-friendly interface and the overall versatility of the system."



*Control panel with NUM's Flexium⁺ 68 CNC installed on the Tank 1300 MCM machining center.*

Another key aspect is the ability that NUM CNCs offer to maintain part program compatibility over the years across all installed controls. "Over the course of our history", continues Ferraboli, "we have built up a library of machining programs that are still used today because they contain all of Meccanica Ponte Chiese's know-how. It goes without saying that it is essential for us to be able to load these programs onto all our machines, including those equipped with the latest generation systems, so that they can be used without having to redo them from scratch every time."



*Headquarters of Meccanica Ponte Chiese in Prevalle, within the province of Brescia*

Last but not least, the after-sales service is also important. "The relationship between NUM and Meccanica Ponte Chiese is a long-standing one, based on openness and collaboration", Ferraboli points out. "In today's market, characterized by increasingly hectic delivery times and almost cut-throat competition, machine downtime is hard to tolerate. That's why it's so important for us to be able to pick up the phone and find a skilled technician on the other end who can solve the problem quickly. And NUM is able to offer us just that."
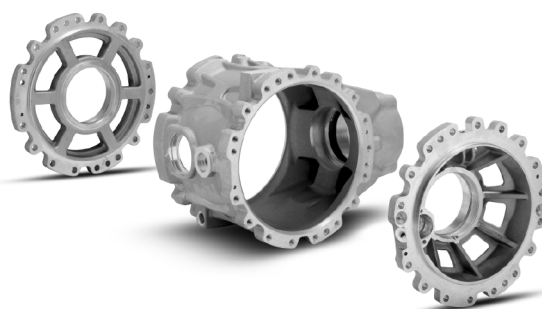
All of these reasons led Meccanica Ponte Chiese to make a very specific choice. In 2018, it decided to purchase a used Tank 1300 MCM machining center equipped with a Fanuc 31i CNC.



*Stator casing of electric motor for forklifts*

"Some time ago", says Ferraboli again, "we found ourselves having to manage a strong peak of work in conjunction with which we had the opportunity to purchase a Tank 1300 horizontal machining center, 4 axes, 10 pallets and a 400-tool magazine. From the very first months of use, however, we realized that the machine's CNC required much longer programming times, as it did not provide us with many of the functions we were used to using with NUM controls and, above all, did not allow us to load our library of programs into the machine. Not to mention the operational difficulties for our technicians."
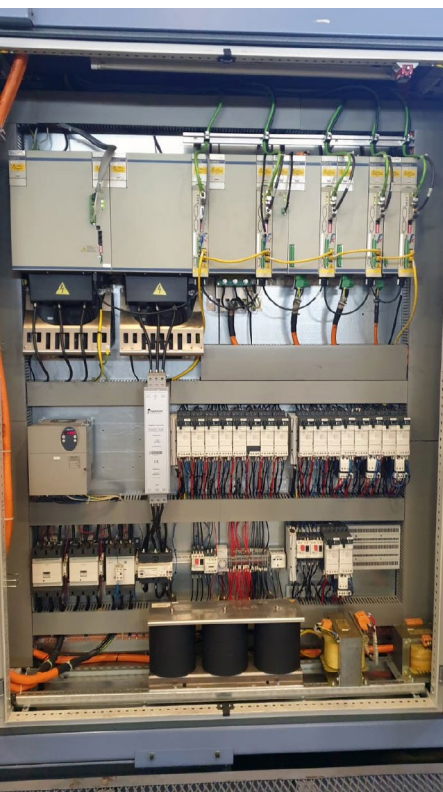
And so, Meccanica Ponte Chiese decided to make a major investment to replace the CNC and equip this machine with a Flexium 68$^+$ CNC, MDLUX drives and BPH series motors.



*Differential housing for media used in extreme environments*



*Switch cabinet with MDLL power supply and MDLUX drives*

*Tank 1300 MCM 4 axis machining center, 10 pallets and 400 tool magazine*



num

# ALMÜ Offers Complete Solutions for Production



**ALMÜ Präzisionswerkzeug GmbH has been using NUMROTO software for 26 years and has been a partner of NUM's from the very beginning. The tools ground with NUMROTO often form a part of the complete solution which ALMÜ develops with their end-users for their own production needs. True to their motto: everything from one source. With NUMROTO, ALMÜ provides a uniform programming environment for use on their wide range of machinery. This benefits not only the tool grinding experts but also the trainees.**

### Customized special solutions are essential at ALMÜ

ALMÜ does not focus on making a standard set of tools, rather the focus is on special high-precision and tailor-made tools. The customer base includes companies from the automotive, mechanical engineering and aerospace industries.
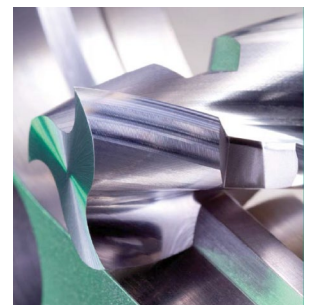
ALMÜ was founded in 1976 by Alfred Müller. In 2007, his son Markus Müller took over the management of the company. The company is based in southern Germany in Zell unter Aichelberg. An important milestone was reached in 2019 with the move into the new building. With almost 50 employees, ALMÜ focuses on speed, precision, flexibility and innovation in addition to the use of state-of-the-art production technologies. In the beginning, the tools were made for grey or nodular cast iron, though today they are mainly made for aluminum. The company's philosophy is embodied by Mr. Müller and his innovative employees.

To be able to offer today's customers with precisely tailored tooling solutions requires technical competence, but also creative and innovative ideas. This often results in completely new tool shapes that offer high productivity and cost efficiency. The solid carbide tools manufactured by ALMÜ are characterized by polished chip chambers, individual cutting edge design and extremely precise grinding. Thanks to the use of NUMROTO, the geometry of the tools can be designed optimally.

### NUMROTO in use since 1994

NUM CNC control with NUMROTO is used widely in ALMÜ's facility. The company started with NUMROTO DOS back in 1994, but now is using the latest NUMROTO*plus*® version. Thanks to constant updates of the software and NUM's ability to enhance the software with additional options, older machines can still be used with NUMROTO to a high standard. Mr. Markus Müller, Managing Director of ALMÜ, clearly sees

strength in the fact that NUMROTO can be supplemented with new options at any time, meeting new customer requirements. He makes it clear: "NUMROTO is the soul of the tool grinding machine. If the software is up to date, we are able to manufacture any special tool."

Mr. Uwe Czommer, production manager, says: "We rely completely on NUMROTO. We now have well over 10,000 tools in our database, mainly drills and step drills, but also



*Form milling cutter in use*

form cutters. All with special features, of course." Before NUMROTO, tools often had to be ground in many individual machining steps; since then, everything can be ground from a blank in one clamping. The on-going development of the NUMROTO software and options that are available are highly appreciated. Likewise, 3D simulation and NUMROTO Draw have become indispensable in production. With the integration of the 3D workpiece simulation including animation of the grinding process and the collision monitoring with 3D machine simulation into the NUMROTO CNC software, a consistent and highly functional solution is created that is easy to use.

NUMROTO Draw creates uniform and realistic product documentation for existing and new tools. This is generated almost completely automatically, which saves time and costs for the end-user. For example, NUMROTO Draw automatically generates the tool outline and the drawing header. This is particularly useful for small runs and resharpening jobs. The software has been greatly enhanced now that it can be used for very demanding tools with multiple section views.



*New ALMÜ building*

**Measuring probe tip**

ALMÜ also uses the versatility of NUMROTO to grind special parts, such as probe tips, which are made of steel. These parts are used in tool grinding machines, along with other applications. The precision of the probe tip is always critical to getting an accurate measurement.

**Everything from one source**

Tools and work fixtures are two devices always used in conjunction with each other. The tool usually comes from the tool manufacturer, while the work holding comes from the fixture manufacturer. When adding engineering, technology, and programming to this; ALMU refers to it as the "all-in-one principle". Only one contact person is required and all processes are coordinated. Mr. Müller posits: "An orchestra does not live from a violin alone, but from the perfect interaction of all instruments. This is also the case when developing a complete solution for production."



*Measuring probe tip*
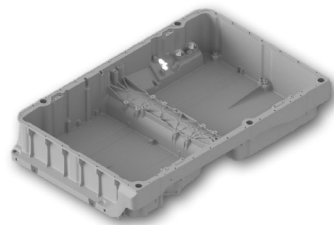


*Battery tray for the electric vehicle industry*

This can be easily explained using the battery tray of an electric car. In order for it to be drilled and milled on a machining center, it must be clamped to a high degree of precision. ALMÜ, therefore, develops and manufactures not only the tools (such as the drills, step drills, and form cutters required), but also the complete clamping device, including the associated engineering. Thanks to this holistic solution, the machining strategy can be efficiently designed and optimized. The "all-in-one" principle includes:

- Creation of tool plans
- Definition of machining strategies
- Determination of the machining parameters
- Time studies
- Tool design
- Complete engineering
- Production of tooling packages
- Solid carbide tools, PCD tools, WP tools
- Completely assembled, balanced and adjusted tool packages are delivered together with measurement reports
- Typical tools and special tool solutions
- CNC programming
- Service and logistics

This adds value for the customers due to the synergy of the principles above.

**Focus on values like education and sustainability**

ALMÜ trains up to five precision toolmakers per year. Great importance is given to ensuring that the trainees get to know the NUMROTO software systematically. Initially, they train on cylindrical grinding machines, and then move on to universal tool grinding machines. Thanks to the uniform user interface, the system is easy to learn. By the end of the apprenticeship, the trainees should be able to produce solid carbide tools on their own. This requires innovation and creativity along with manual skills to succeed.

ALMÜ is not only thinking about the future during training, they are also focused on sustainability. With a state-of-the-art cooling oil treatment and filter system, the environment is protected to the greatest possible extent and resources are saved. For decades to come, this investment will be crucial to production and the environment. At ALMÜ, environmentally compatible action and sustainable management is an important element of corporate policy.

**High market presence also in the future**

ALMÜ and NUM will continue to work together. Mr. Müller affirms: "With NUMROTO every crazy idea can be realized. So we have a strong presence on the market and convince with our innovation and highest precision."



*Tool grinding machines with NUMROTO software in ALMÜ's machine park*



*From right to left: Mr. Uwe Czommer, Production Manager, and Mr. Markus Müller, Managing Director, both from ALMÜ Präzisionswerkzeug GmbH, with Mr. Jörg Federer, Manager Application Technology NUMROTO NUM AG*

# Supertec Chooses NUM Technology for its Latest CNC Cylindrical Grinding Machines

**Supertec Machinery Inc., one of Taiwan's leading machine tool manufacturers, has chosen to base new versions of its renowned Plunge type of CNC cylindrical grinding machines on NUM's Flexium$^+$ CNC platform.**

Founded in 1954, Supertec Machinery Inc. has grown to become one of Taiwan's top machine tool manufacturers. The company specialises in precision grinding automation and produces a diverse range of centreless, cylindrical and surface grinding machines. Based in Taichung City, Supertec operates sales and support facilities at strategic locations throughout Asia and Europe, as well as in the USA and South America.

Supertec has traditionally used Fanuc CNC systems for most of its machine tools. However, when NUM added non-circular grinding functionality to its popular NUMgrind cylindrical grinding software back in June 2020, the company realised that this innovative CNC technology provided exactly what many of its customers needed on their cylindrical grinders.

NUMgrind simplifies the creation of G code programs for CNC grinding machines through the use of a highly intuitive graphical human machine interface (HMI), and unlike conventional CAD/CAM workstation tools, it is designed specifically for use by shop floor personnel in a production environment.

After evaluating the software, Supertec immediately raised a purchase contract with NUM. According to Betty Chu, Supertec's Assistant General Manager, "NUM has an excellent reputation in the grinding industry. Much like Supertec, this has been earned over many years. And the latest version of NUMgrind, which accommodates non-circular grinding, is a natural fit for our CNC cylindrical grinding machines. We also now benefit from very responsive local support – NUM's Taiwan facility is less than 15 km away from our factory."
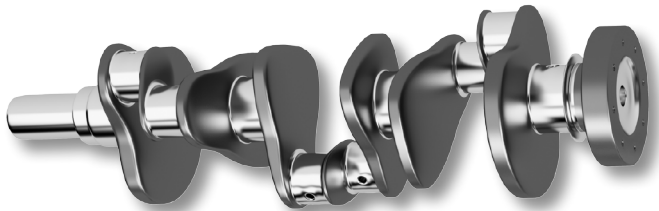
*Supertec's latest Type Plange CNC cylindrical grinding machine is based on NUM's Flexium$^+$ CNC platform*

*From left to right: Mr. Chu, General Manager of Supertec, and Adrian Kiener, CSO Asia NUM*

Supertec's Plunge type of CNC cylindrical grinding machines offer a choice of six capacities, covering distances between centres from 500 mm to 2,000 mm. The machines can also accommodate grinding diameters from 300 up to 430 mm (3 sizes), grinding wheel speeds up to 1,390 rpm and workhead spindle speeds from 30 to 350 rpm.

The new versions of these machines are based on NUM's Flexium$^+$ 8 CNC platform and use NUM's high performance MDLUX drives and brushless servo motors for the X, Z and C axes. In addition to the NUMgrind HMI, the software that is being supplied by NUM includes the Flexium 3D simulator, which can be used offline or online, and an application-specific profile editor which enables users to import DXF files.



*Supertec's latest Type Plange CNC cylindrical grinding machine accommodates complex parts requiring non-circular grinding*

Johnny Wu, General Manager for NUM Taiwan, points out, "The ability to use the Flexium 3D simulator both offline and online provides Supertec's customers with a distinct advantage. CNC programs can obviously be prepared offline and checked for potential problems such as collisions before being transferred to the machine. But the simulator can also be used online. This enables operators to gain vital visibility of the grinding process – which is normally obscured by the flow of oil."

The new machines will be introduced to the public at the next opportunity, which will likely be TMTS in 2022 due to Covid-19 restrictions.

**Technical background**

Non-circular grinding is used in a wide variety of automated manufacturing applications, such as the production of camshafts, crankshafts, cams and eccentric shafts. However, it is an extremely complex task, because the non-circular contour leads to constantly changing engagement and movement conditions between the grinding wheel and the workpiece.

Using the non-circular grinding function of NUMgrind, the closed shape of the workpiece is defined in the XY plane. Grinding is then performed by interpolating or synchronising the X axis with the C axis (workpiece spindle). Axial movement in the Z axis can also be accommodated, by means of oscillation or 'multi-plunging'. The Flexium$^+$ CNC system's NCK transforms the contour from the XY plane into an XC plane, and calculates the corresponding compensation and in-feed movements, taking the grinding wheel diameter into account. The speed profile is also transformed, so that the speed and acceleration are automatically adapted to suit the physical attributes of the machine.

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# Three Flexium+ Systems at the Service of Italian Manufacturing




Meccanica Ponte Chiese
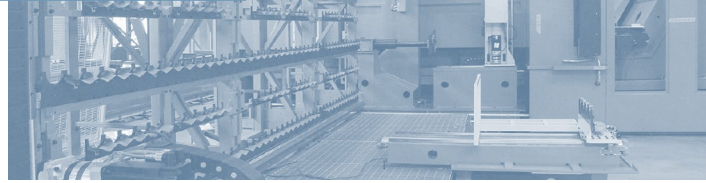
**Invest to grow and then invest again. NUM's long-standing customer Meccanica Ponte Chiese has pursued this strategy ever since the company was founded. It also has a policy of only using MCM-branded machine tools, equipped with NUM CNC systems. This year – a dramatically special year – saw the latest technology investment: an MCM Tank 2600 horizontal machining center equipped with three Flexium+ systems and special handling automation which was also developed by NUM.**

Meccanica Ponte Chiese is a typical small to medium-sized Italian company specializing in contract machining for a variety of sectors, and has made technological innovation its strong point. Technological innovation requires initiative and farsightedness – two qualities that the Ferraboli family (consisting of the founder Giovanni, today flanked by his children Gianluca, Mirko and Monica) certainly does not lack – and that cannot disregard the choice of technological partners able to offer high added value over time. For this reason, the history of Meccanica Ponte Chiese is closely linked to that of NUM for all that concerns the supply of numerical controls and to the manufacturer MCM for the supply of machines.

Working in today's marketplace means facing constant challenges, with ever-smaller batches, high levels of customization, and timescales 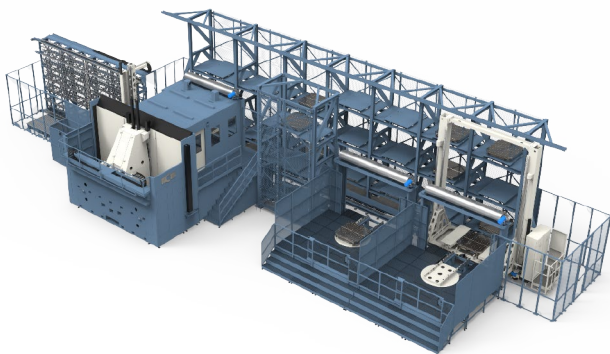and costs that overlap with those of mass production. "Our customers are mostly multinationals that are also based in Italy", explains Gianluca Ferraboli, production manager. "This means that in many cases the products we make are destined for plants located all over the world. Often we manage to win an order thanks to the fast delivery times we can guarantee and the quality of our work."

In order to meet market needs, Meccanica Ponte Chiese has been focusing on technological innovation for years. In fact, the eleven MCM machining centers in the Prevalle (Brescia) plant operate 24 hours a day, 7 days a week, thanks to the physical presence of 16 specialized

technical workers who cover two shifts and are able to work on all the machines, each managing up to three at the same time. "We can say that we have been acquiring the concepts related to Industry 4.0 for over twenty years, when they were not yet called that and there was no talk of a smart factory", continues Gianluca Ferraboli. "Today, everything that moves in our factory is automated and networked, and the decision to install only MCM-branded machines, all equipped with NUM numerical controls, is also dictated by the fact that, once an operator has been trained, he or she is then able to operate all the systems."
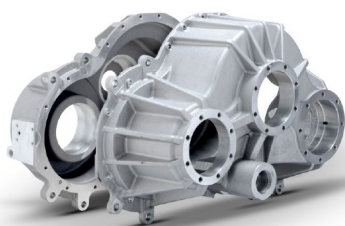

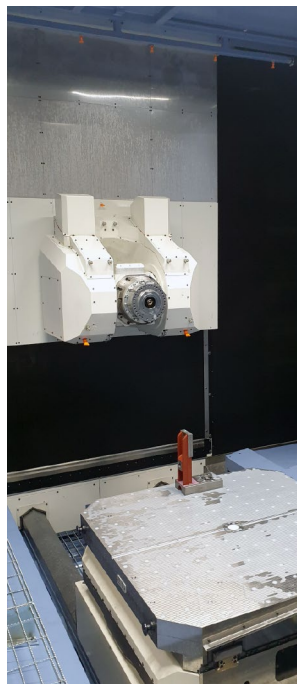*The Tank 2600's magazine is designed to accommodate 1,200 tools.*

Meccanica Ponte Chiese's latest technological investment – aimed at further reducing cycle times and reaching those market niches that require the machining of large parts (such as the naval sector or those linked to the construction of presses) – once again involves an MCM system. It is a Tank 2600 5-axis horizontal machining center with JFMX automation and management supervisor, built according to the company's specific requirements and equipped with 1,200 tools and 21 pallets of 1250x1250 millimeters with a 50-quintal capacity handled by an automatic shuttle. The machine has been designed to work 24 hours a day and is the first step of a larger system, which includes a second, mirrored machining center that will be installed at a later date.


*Rendering of the MCM Tank 2600 5 axis horizontal machining center now being installed*

The system consists of three Flexium⁺ systems from NUM, namely Flexium⁺ 68, Flexium⁺ 8, drives from the MDLUX range complete with Safety functions, and brushless motors from the BPH and BPX ranges. The systems are networked in order to share plant information. A Flexium⁺ 68 system manages the machining center and the movement of the 1,200 tools. A solution with Flexium⁺ 8 takes care of the operator workstations. For example, the areas where workpieces are loaded and unloaded – and a second solution, also equipped with Flexium⁺ 8, manages the pallet handling trolley. As with the other machines, the entire system is linked to a supervisor to manage the production side, i.e. the machining of the parts, the various types of tools and so on. As well as supplying the hardware, NUM was also involved in the total development of the machine automation in this particular case, supplying – according to MCM's specifications – the PLC program for all parts, i.e. the machine, operator stations and trolley/shuttle.

*Working area of the Tank 2600*

"The main advantage was that we were able to integrate our solution in the best possible way", comments Marco Battistotti, NUM's NTC Italy Director. "Working with MCM once again has allowed us to exploit the potential of the numerical control on the machine to the full. Added to this is the advantage that NUM now has detailed knowledge of the plant and its functionality in terms of maintenance. This is important in order to be able to offer an even better after-sales service.

*Engine side housing for vehicles used in extreme environments*

*Electric control panel working center with MDLUX Drive*

*Above, from the left, Gianluca and Mirko Ferraboli, production and technical department managers respectively. Below, founder Giovanni Ferraboli with his daughter Monica, head of administration at Meccanica Ponte Chiese*

# Advanced Multi-Axis CNC Machine Tools Provide Indian Shoe Last Manufacturer with Unique Competitive Advantage

**Rupmaya Shoe Last Industries, India's largest shoe last manufacturer, recently completed a major CNC machine tool upgrade programme which has enabled the company to increase production capacity to 1,500 pairs of quality shoe lasts per day.**

The CNC machine tools are all based on NUM's Flexium CNC platform, and are produced by the specialist Italian company, Newlast.

Founded in 2002, Rupmaya Shoe Last Industries Pvt. Ltd has grown to become one of the largest manufacturers of adults' and children's shoe lasts in India. The company's headquarters are located in Agra, and it also operates production facilities in Kanpur and Ambur, as well as a product development centre in Noida. Rupmaya's customers nowadays include many of the world's leading shoe manufacturers.

Although it started out as a traditional craftsmen-based manufacturer, Rupmaya decided to transition to CNC machines at an early stage in the company's development. An initial investment in CNC technology from the Far East proved unsatisfactory on quality and support grounds, so in 2017 the company procured a state-of-the-art shoe last milling machine from Newlast for evaluation purposes.

Rupmaya was so impressed by the performance of the Newlast machine, and by the ease of control provided by the machine's CNC system, that it took the strategic decision to differentiate itself from competitors by migrating all of its production facilities over to Newlast machines. The entire upgrade programme, which represented a major investment by the company, took three years to implement and was finally completed in 2020.



*Rupmaya makes extensive use of Newlast CNC machine tools, which are based on NUM's Flexium CNC platform*

*A team of technicians, led by Rupmaya'sDirector, Mayank Agarwal, spearheads research and development*



According to Mayank Agarwal, Director of Rupmaya, "We were the first company in India to use Newlast machines with their patented 'SDF' shoe last clamping technology. From the outset, the improvements in product accuracy and quality were apparent to our customers and quickly gave us a competitive edge. The control flexibility provided by NUM's Flexium CNC systems makes the machines extremely easy to set up and use – our operators only need a few days of training. We are currently running three production lines simultaneously, giving us the capacity to craft over 1,150 pairs of lasts, as well as more than 350 pairs of samples, every day."

Rumpaya's production facilities make extensive use of Newlast's latest generation SDF HS machines, which can finish three pairs of plastic or wooden lasts automatically during a single working cycle. As Rajesh Nath, Managing Director of NUM India, points out, "These machines, which are based entirely on NUM's open architecture Flexium CNC platform, have 9 interpolated axes and are capable of producing about 45 pairs of highly accurate, fully finished shoe lasts per hour."



*Rupmaya applies strict quality control to every aspect of manufacturing*



*Rupmaya in India*

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