



# numroto® flash 12

**NUM** 

Issue No. 12, October 2009

## The only constant is change

"The only constant is change". Today this quote is ascribed to the Greek philosopher Heraclitus of Ephesus (c. 540 - 480 B.C.). He was convinced that everything is constantly in flux.

The situation in which the overall market economy finds itself today gives a new emphasis to the validity of this conviction. Within just a few months, the economic situation has dramatically worsened. If you believe the prognoses, then the economic outlook for 2010 appears similarly muted. At the moment, only a few really believe in a rapid economic recovery. Both highs and lows are a part of our economic system.

Companies are well advised to recognise the chances the crisis also offers. Such an abrupt change to the general economic situation can also provide thought-provoking impulses, which in economically better and calmer times would not have stood a chance. What can be done to overcome the crisis? First and foremost, stay calm - difficult situations require strong nerves and well-considered and consistent actions.

Since the increasingly difficult times began, we have taken action and steadily and cautiously adapted to the situation (management of cash, stock, investment and human resources, etc.). This allows the company's

substance to be retained and it provides us with a basis for the further expansion of our activities. NUM offers its customers a comprehensive portfolio for the automation of machines.

In order to do justice to our motto "NUM - CNC - solutions help machine manufacturers to a competitive advantage", we deliver complete solutions for the automation of CNC-controlled machines, which demands far-ranging knowledge from us in a wide variety of disciplines. As the employees at NUM are well aware, our partner's success is also our own success. Over the past 20 years and more, decisive market advantages could be gained for many machine users and manufacturers.

NUMROTO is today's trendsetter in tool grinding. This can be attributed to the close partnership between the machine manufacturers, users and ourselves, in combination with our knowledge-intensive CNC total solution strategy. We will continue to pursue this strategy in future, as well as intensifying it. From my point of view, this economic crisis offers a number of opportunities to consolidate NUM as a supplier of CNC total so-

lutions for tool grinding even further. From the 5th - 10th October 2009 we will, in turn, be presenting a number of innovations at the EMO in Milan, at a stall with the exact same size as in 2007. Among other things, you will also be able to watch the new 3D simulation featuring a removal rate animation. This new function means it is possible to select the optimum grinding feedrate, in every case and in a straightforward manner. A real advantage for production!

CNC-controlled machines in general and tool grinding machines in particular are our greatest passion. We think and take action for the long term and are therefore, both today and in the years to come, nothing less than an attractive and reliable partner for our current and our future customers.

*Peter von Rüti, CEO NUM Group*

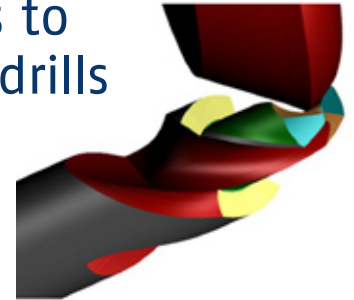


**numroto**<sup>®</sup>  
Total solution for tool grinding

**MILLER**

## Advanced CNC simulation software helps to produce an innovative new range of twist drills

**CNC multi-axis grinding machines using NUM's NUMROTOplus 3D simulation and control software are helping Miller Präzisionswerkzeuge GmbH to manufacture a new series of high-performance MAPAL-brand solid carbide twist drills. The new drill tools employ complex optimised profiles to accelerate cutting speeds.**



The NUMROTOplus software allowed Miller Präzisionswerkzeuge to visualise and optimise the complex machining process required to produce the new drills in 3D, before putting the new drill range into volume production.

"The NUMROTO features helped during the development of our latest MAPAL drill products, and we made extensive use of the advanced 3D simulation ca-

software for a number of years, and are now in the processing of running it out across all our machines. By effectively standardising on this one package, with a consistent user interface, we will reduce our personnel training costs and help maximise productivity, while maintaining the product quality for which we are renowned." To cope with demand, Miller Präzisionswerkzeuge recently doubled the size of its

the NUMROTOplus software – which operate for three shifts per day, 365 days of the year – making it one of the most modern solid carbide tool and drill production plants in the world. It is widely acknowledged that more than 30 percent of productive machine time is nowadays taken up by drilling operations. Typically, these include pilot drilling and pre-centring, drilling, reaming, countersinking, boring out, de-burring and thread cutting. By combining some of these operations in a single step, it is possible to decrease machining time significantly, but only if the drilling tools feature task-optimised profile geometries – factors such as chip removal, heat dissipation and tool stability are critical.



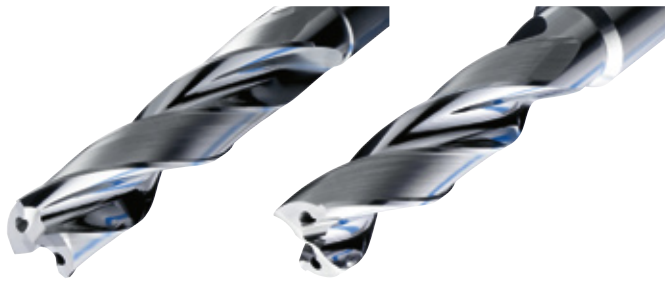
*Ulrich Krenzer, Technical Director, Miller Präzisionswerkzeuge GmbH / MAPAL Group (left), and Walter Grob, head of sales NUMROTO, NUM AG Switzerland (right).*

pabilities of NUMROTOplus software, including its tool collision monitoring procedures, to optimise our manufacturing process," says Ulrich Krenzer, Technical Director of Miller Präzisionswerkzeuge. "We have used NUM's CNC

R&D and manufacturing operations at Altenstadt in Germany, culminating in the opening of a new 7000 m<sup>2</sup> production facility in November 2008. The facility contains more than 40 CNC grinding machines equipped with

The new MAPAL 'Mega Speed Drill' is designed for high speed drilling of steel and iron. It features an asymmetric tip, with reinforced cutting edges. The 3 margins are designed in such a way that the drill will slightly oversize the holes so the friction between the margin lands and the workpiece will be minimised. This geometry makes the drill relatively insensitive to high cutting edge temperatures and corner wear. The specific, polished flute geometry guarantees a free flow of chips. The drill can be applied with a very high cutting speed of about 200 m/min when machining steel, enabling drilling times to be reduced by as much as 70 percent compared to conventional products. For example, when used to drill annealed 42CrMo4 under these high performance cutting conditions, the tool has a typical lifetime of 60 to





70 m, reducing the production cost per bore by as much as 50 percent. Miller Präzisionswerkzeuge has also just developed a twist drill which produces a bore with a flat 180 degree bottom. Normally, this would require two machining operations, one to drill the bore to the required depth and one to perform counter-boring. A special tip profile on the new 'Mega Drill 180' ef-

fectively combines the two operations in a single machine cycle. The drills are ground with an S-shaped point thinning, which delivers good chip control and a profiled concave flank to produce a flat bottom hole. The tool can also be applied for piloting at inclined surfaces. The flat point reduces here the radial forces compared to conventional drill points with a 140° point angle.



*Machines in full production operation, being attended by just a few workers.*



## NUMROTO at the EMO 2009 in Milan

Come and visit NUM at this year's EMO in Milan for a comprehensive introduction to NUMROTOplus. A NUMROTO specialist will be at the NUM stand throughout the entire exhibition, from Monday, 5th October to Saturday, 10th October. You will find NUM in **Hall 3, Booth F05.**

Of course, there will also be a large number of grinding machine manufacturers with machines on site which are equipped with NUM CNCs and NUMROTO. These are namely:

Exhibitor:	Hall:	Booth:
<b>Saacke</b>	6	L03A
<b>Ewag</b>	6	G02D
<b>Michael Deckel</b>	6	G06
<b>Farman</b>	6	N06
<b>TTB</b>	6	L03B
<b>Hawema</b>	6	L07

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**NUMROTO at the EMO:**  
**Halle 3, Booth F05**

**NUM**   
CNC HighEnd Applications

## 3D simulation with removal rate animation enables the optimum selection of the machining feedrate

Over the course of the last 20 years, the NUMROTO programming system has developed into a comprehensive overall solution for tool grinding. Many of the 2,500 NUMROTO customers began as small businesses (grinders) and have evolved into successful enterprises with several tool grinding machines. One of the factors contributing to the success of these customers is their universal use of NUMROTO. Alongside "usual" applications such as the production and grinding of standard tools, the software also covers numerous special applications and niches, which guarantees a high level of added value. The new NUMROTO Version 3.0 has been enhanced substantially. It allows, as shown in the following, the optimum machining feedrate to be selected based on grinding wheel technology data.

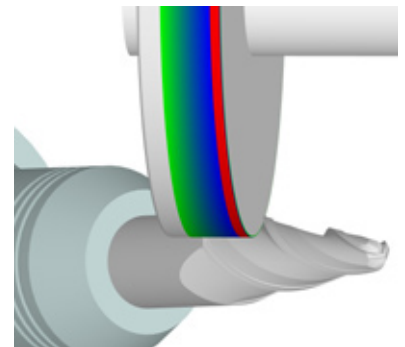


Figure 1: On the wheel rim, the removal is animated using different colours.

Grinding wheel manufacturers state a maximum specific removal rate volume/time (specific material removal rate). This important technological factor is also referred to as  $Q_{w\max}$ . It specifies the maximum quantity of material removal at every point of the grinding wheel rim in mm<sup>3</sup>/second, based on a rim width of 1mm. In practice, there are approximation formulas used to calculate the machining feedrate from the  $Q_{w\max}$  value. These approximations are, however, often imprecise. Consequently, the user selects the machining feedrates in many cases according to "instinct". An unfortunate choice will result in either unnecessarily long grinding times (feedrate too low) or high wear on the grinding wheel (feedrate too high).

These process uncertainties can now be avoided: The 3D simulation by

NUMROTO has been enhanced so that at every moment of the simulation and from every point on the grinding wheel it is possible to determine exactly how much material is being removed. This removal is compared with the  $Q_{w\max}$  value which has been recorded in the wheel databank for each grinding wheel. Depending on this comparison, the rim of the grinding wheel is animated in different colours, and the colours can be configured. In figure 1, the area in which the removal rate exceeds the programmed limit value is animated in red, while the green to blue colours indicate those areas with little to normal material removal.

While grinding a tool, the material removal changes constantly. For example, the removal rate on a conical tool is low on the face side, and higher towards the shaft. The active grinding wheel therefore continu-

ally changes its colour during the simulation. For a better overview, the course of the maximum removal rate can be displayed in the grinding time function (see figure 2): In this example, the peripheral wheel almost reaches its maximum permissible removal rate at the flute end. On relief 2, the cup wheel removes considerably more material than on relief 1. The operator can easily recognise that the removal rate exceeds the maximum permissible value of the cup wheel on relief 2. Logically, the feedrate has to be reduced for relief 2.

NUMROTO reliably detects any such overloading. The optimum feedrates have been chosen when the grinding wheels remain under the maximum permissible removal rate for each machining operation (indicated in red in figure 2). This is easy to reproduce for the programmer.

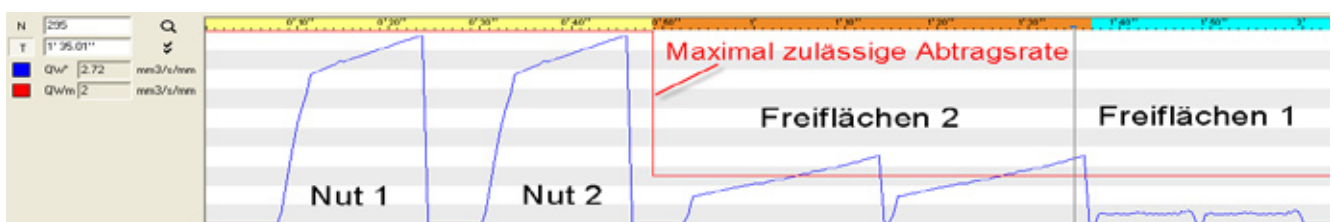


Figure 2: Course of the removal rate during grinding of a conical cutter

### Example: Form wheel for drill flutes

Drill flutes are often ground using profile grinding wheels. The tool engineer specifies the flute or the drill face geometry and NUMROTO calculates the shape of the grinding wheel, allowing for the twisting. As a result, new drill face geometries, for example with convex major drill cutting edges, can be developed and ground quickly. A profile grinding wheel is shown in figure 3a and its surface colours correspond to the removal rate. The red area, where the removal is unacceptably high, is easily visible. If the machining feedrate is reduced by 20%, then there is no longer any overloading (see figure 3b).

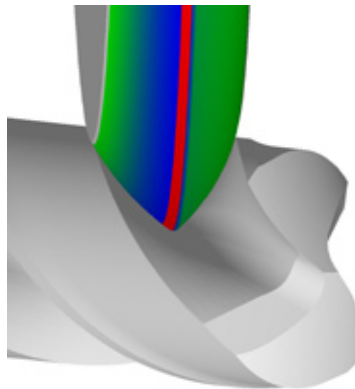


Figure 3a:  
Form wheel with feedrate 250 mm/min

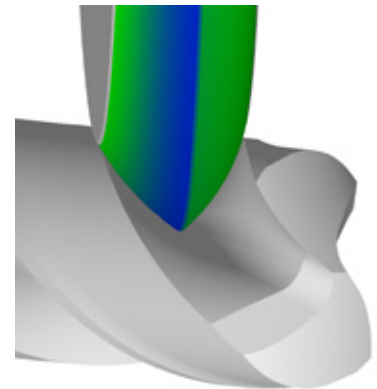


Figure 3b:  
Form wheel with feedrate 200 mm/min

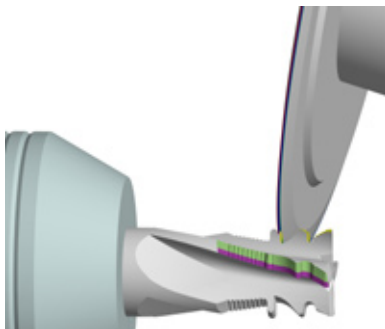


Figure 4a:  
Tip wheel

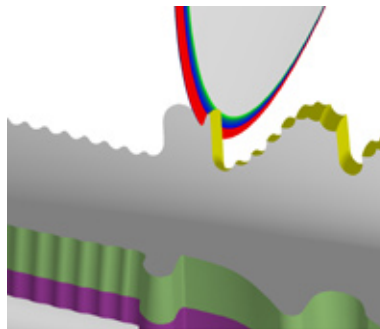


Figure 4b:  
Tip wheel enlargement

### Example: Form grinding with a tip wheel

The animation of the removal rate can also be effectively used for form tools which are, for example, machined using tip wheels. Tools like these are often roughed with radius wheels in a plunging operation. In the event that the roughing cuts have been made unfavourably, the tip wheel must remove a lot of material in a short time in the subsequent finishing process. As tip wheels react to local overloading very sensitively and in this case wear quickly, the benefits are particularly great.

### Summary

The enhancements to NUMROTO 3.0 described above allow the removal characteristics of the active grinding wheel to be assessed at any stage of machining, both in the form of a coloured animation as well as in a time diagram. Feedrates can be programmed optimally, so that the grinding wheels never exceed the maximum permissible removal rate. This guarantees an optimum production time with only minor wear on the grinding wheel. Existing NUMROTO systems can be retrofitted with this function.

## We go the extra mile

Manufacturing tools can be an enormous challenge. Ultimately, the aim is to make the most efficient tools possible, which in turn must produce milled and lathed parts with increasing complex geometries using materials with very special characteristics. Users demand ever more complicated geometries and narrower tolerance ranges from our tools. The machining times for the workpieces must be reduced, while the durability of the tools must increase. These expectations are a real challenge for the tools and their designers. So naturally, many of these tools go beyond what

could be classed as standard. Finding new solutions and innovations to meet new challenges is what pushes us all forward. Our close partnerships with machine manufacturers and operators enable us to understand precisely what is required. This will always be the basis for creating highly customer-oriented solutions. I think we can all agree that the better the solution, the greater the success.

Walter Grob  
Head of sales NUMROTO





## NUM group successful at CIMT 2009 in Beijing



The 11th China International Machine Tool Show took place in Beijing from 6th to 11th April 2009. The CIMT is the largest metalworking exhibition in China. NUM could be found in Hall W1, Stand E120, where it invited visitors with an open stand, bright and 52 m<sup>2</sup> large. Alongside the established NUM systems, NUMROTO was also present at the stand with its innovative software for the tool-grinding industry. Visitors were treated to a live demonstration, on two technical wall panels, of the

two complete CNC systems, Flexium 6 and Flexium 68. The new axis motors from the BHX series round off the product range of NUM motors and are distinguished both by their favourable price/performance ratio as well as their very compact dimensions.

There were also some very interesting contacts and enquiries made regarding new products from the NUMROTO group. The large number of visitors and the great interest shown serve

to underline that the Chinese market still offers numerous prospects for NUM. It gives the group new impetus to develop this market further. The CIMT is one of the four most well-known machine tool exhibitions in the world. 1,100 exhibitors from more than 28 countries and regions of the world make it an important venue for presenting a company's latest achievements to the international public.

## The most important innovations between 2.9.1 and 3.0.1

All relevant enhancements and improvements can be found at: [www.numroto.com](http://www.numroto.com) > Customer Area

### NUMROTO general

*Cylindrical grinding – Face grinding – Peripheral grinding*

Diverse modifications in the area of cylindrical grinding. Among other things, a switchover between peripheral grinding and face grinding is now explicitly possible.

### Manual cutting direction

The cutting direction can now be individually programmed under <Diverse> (irrespective of the basic geometry) for most machining operations.

### In-process measurement protocol

When measuring in process and using NR control, an additional file with the measured values is generated in the .csv format. This can be analysed using Excel, for example, when required.

### Direct integration of ISO-CNC commands

ISO commands (G code) can now be typed straight into NUMROTO at various points (for example, as a retraction program for a grinding operation). These program lines are now saved together

with the tool and automatically transferred to the CNC when grinding. In addition, these G code commands are also simulated in NUMROTO-3D.

### NUMROTO 3D

*Package nut and spindle diameter display*

The spindle diameter as well as the dimensions of the spindle nut can now be individually programmed for each package. This form is subsequently used for the 3D simulation.

### QW<sup>o</sup> analysis

Analysis of the removal rate of the grinding wheel in reference to the width of the wheel. This allows the so-called QW<sup>o</sup> to be calculated. Furthermore, there is a visual presentation of the heavily loaded areas on the grinding wheel. This new function is available as an optional extra.

### Cutters

*Front length modification*

The required helical length modification of the flute at the cylinder start is now determined automatically using an autotswitch.

### Bevel edge reliefs on multi-helix cutters

The bevel edge reliefs now also follow the various helix angles when a multi-helix cutter is programmed.

### Step drills

*S-gash out*

The rounding radius and the rounding angle are now automatically determined for the drill S-gash out.

### Point reliefs

The machining direction can now be selected for the drill point reliefs as well. In addition, peripheral wheels can now also be used for grinding point reliefs.

### Milling cutters

*Diameter offset to helix A*

A diameter offset from helix B to helix A can now be programmed. This way, two helices can now be coupled together in relation to diameter.

### Clamping system transformation for each machining operation

A programmed clamping system transformation can now be switched on or off for every machining operation.