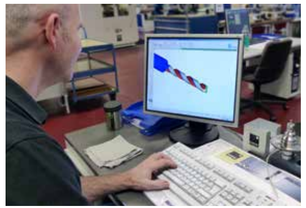
Left: internally cooled trapezium-toothed roughing cutter with AN coating.

Over 50 years of experience and know-how

This statement applies equally to both companies, KLENK and NUM with NUMROTO. Decades of experience and research, cooperative partnerships – such as in this case between KLENK and NUM – and close collaboration with users and leading research institutes, serve to guarantee successful and high-quality drilling and milling tools. These tools are used mainly in high-tech sectors such as the aviation, automotive and medical equipment industries.

From left to right: Jörg Federer, NUMROTO Application Manager at NUM AG, Horst Klenk, owner and Managing Director of KLENK, and Klaus Kohlhepp, Head of Production at KLENK.

The family business KLENK was established in 1959 in Balzheim in the German state of Baden-Württemberg, and for over 50 years has specialised in the development, production, use and sale of high-quality carbide machining tools for drilling, countersinking, reaming and cutting. KLENK currently has over 100 excellently trained employees, many of whom have completed their commercial or industrial training at the company. This is how KLENK ensures that its knowledge and know-how of the production of specialist solid carbide tools, which account for around 85% of KLENK's sales, are in the best hands. Moreover, personal, skilled and technical advice and project planning with customers and partners are particularly important. And this is where NUM comes in: the productive collaboration with KLENK over the last 15 years is based on an honest and subject-oriented partnership that involves pursuing and realising a common goal, in keeping with the motto of "NUM CNC solutions provide machine manufacturers and users with a competitive advantage". KLENK also secures its know-how digitally with a multi-user database from NUMROTO. This enables KLENK to meet its own high expectations of full reproducibility of tools with repeat orders thanks to the NUMROTO data structure. All of KLENK's machines are connected to the multi-user database, making it possible to act flexibly within identically configured machine groups; this facilitates short reaction times and optimal capacity utilisation. Added to this is the benefit that every employee can work on almost every machine, as all machines use the same NUMROTO control system.



Its close connection to customers and suppliers enables KLENK to set itself apart from the masses and develop the perfect tool tailored to meet the needs of the customer. The images on this page are examples of the results of such developments. The flexibility of the NUMROTO software solution plays an important role in the process as a whole and significantly simplifies the procedure. From planning, simulation and, of course, production, to documentation and the subsequent management and securing of data – all of this can be done with NUMROTO.

Tools for the aviation industry

KLENK has been working successfully with the aviation industry for a long time, and in this industry, high-performance tools are required for the machining of aluminium, titanium and composite materials. With milling tools, flute design and tooth geometry in the area around the corner radius are crucial to the resulting surface quality in cutting, as well as to the lifetime of the cutter. In-process measurement guarantees a high level of accuracy, even across larger series.

CFRP – carbon-fibre-reinforced polymer: the trend material of the future!

CFRP is becoming increasingly popular, and KLENK is continuously developing new tool geometries for this material. CFRP is used to manufacture resilient and robust components with relatively little weight. In the aviation industry, CFRP is frequently used in combination with other materials such as titanium or aluminium. This results in connection points at which two or more different materials have to be drilled through simultaneously. Most of the materials used have specific, opposing properties, which make machining in the material package a real challenge. In addition to its undisputed positive properties, CFRP also has a crucial disadvantage: if the material is drilled or milled, it becomes extremely abrasive and quickly causes heavy wear to the tool. This is especially problematic because the machining results for CFRP applications must meet the highest possible quality standards. These require first-class surface finishes and the maintenance of diameter tolerances, as well as the avoidance of delamination and fibre projection. The specialist tools from KLENK meet all these requirements.

Left: step drill countersink with an S-shaped point thinning and AF coating – for a high level of process and planning security.

Top left: high-performance step drill countersink, for applications in aviation.

Top right: step drill countersink with diamond coating for processing of CFRP.

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CNC HighEnd Applications

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GrindTec
19th – 22nd March 2014, Augsburg, Germany

IMTS 2014
8th – 13th September 2014, Chicago, USA

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2014 trade shows with NUMROTO

NUM will be showcasing NUMROTO at various trade fairs around the world this year. We will be presenting the latest NUMROTO innovations and will be available for constructive discussions. Come and visit us at the trade fairs listed above. Our team is looking forward to meeting you. Our hall and stand numbers will be listed on our website (www.num.com) before the beginning of every trade fair.

There will, of course, also be a number of tool grinding machine manufacturers at the trade fairs whose products are equipped with NUM CNC systems and NUMROTO.

Backing up data, know-how and programs

Tool grinding machines often have a service life of 15 to 20 years. Over the course of this time, a huge amount of know-how is accumulated in the associated programming system, which may be decisive for the future of a company. Professional data management, updates and backups are essential factors in this context.

A sophisticated management system in a multi-user database solution allows the fast location of programs of previously ground tools together with the corresponding documentation, such as drawings and photographs. As today's PCs often have to be updated and equipped with the latest Windows operating system version after just a few years, the programming system also has to be updated several times during the service life cycle of a tool grinding machine. The process shows how well thought out and economic the software is: NUMROTO has been upward compatible since the first Windows operating system version. Many customers benefit from this, as they have been able to migrate their data effortlessly over the years without losing time. NUMROTO updates are provided free of charge to machine manufacturers so that they, in turn, can offer very economic software updates to their customers. Therefore, the maintenance costs for NUMROTO users are very low.

Data is threatened by hardware problems (e.g. crash of a hard disk, lightning strike, power loss), software problems and human error (e.g. accidental deletion of data). NUMROTO guards against these problems by providing a sophisticated backup concept that enables regular automated data backups.

Peter von Rüti, CEO NUM Group

New generation of flutes

These days, the success of a tool grinding company is often very much dependent on the performance of its CNC machines' programming system. The more complete and sophisticated the system, the more rapidly and flexibly the company can react to the needs of its customers. Thanks to the high performance levels of modern PCs it is now possible to handle extremely complex path calculations, paving the way for much more versatile machine tools. Some of these new possibilities are presented below, based on the new generation of flutes from NUMROTO.

Many of today's end mills are ground with a multi-helix. Each cutting each is specifically twisted differently to avoid vibrations. Sometimes, the helix angle changes not only from one tooth to the next, but also along each individual cutting each from the tip to the shaft (differential helix). The width of the flute area of these tools can vary greatly. Despite these complex requirements, the grinding wheel can be automatically positioned to ensure that the land width on the back of the tooth is correct.

For reasons of stability and to optimise chip transport, the core geometry between the tip and the shaft often needs to be variable in design. This is increasingly required by the customer, not only for drills but also for end mills. Where tools have irregular helicest or division, the core path can be defined individually for each flute. This can compensate for any potential imbalance.

These and other possibilities of the new generation of flutes from NUMROTO form an important foundation for future tool developments. We are excited about the new tool geometries that our customers will launch over the next few years.

Let us show you NUMROTO 3.8.0 with the latest generation of flutes at GrindTec 2014 in Augsburg!

Fig. 1: Constant land width on a corner radius cutter with multi helix and differential helix (core diameter variable)

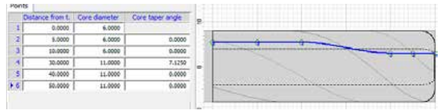


Fig. 2: Core path

It has been possible to grind defined rake angles on cylindrical or conical flutes for years. But what about more complex body forms or cutting edges which pass from the body to the tip?

The entry point for the grinding wheel follows the corner radius, thus creating a defined rake angle along the corner radius. The support rekief angle 1 behind runs in parallel.

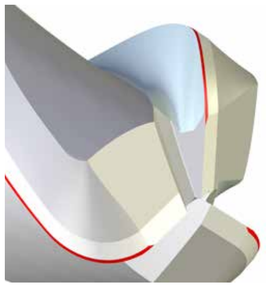


Fig. 3: Transition from corner radius to body

Profile inserts

Today, the majority of rotary tools are ground from solid carbide. For large tools – some of which cannot be produced or maintained in a tool grinding machine, or only with a huge amount of work – and for non-rotary tools, it is more cost-effective to grind only the carbide inserts of the tool and then fit them in a more cost-effective 'holder' at a later date. These 'holders' can be, for example, cutting heads, knife heads or turning tool holders. This is now implemented as follows in the NUMROTO form cutter software:

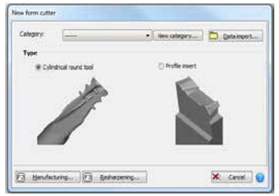
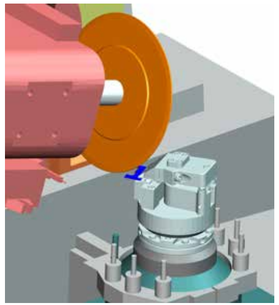


Fig. 1: Differentiation between rotary tool and profile insert

Fig. 2: 3D model of production clamping system (working image by Michael Deckel)



A cutter that is ground from a 'whole' or a knife blade with soldered-on inserts is defined as a rotary tool. These tools are usually clamped in the grinding machine and ground. They can also be programmed as form cutters in the normal way. The position of soldered inserts can be scanned individually, which allows inaccuracies to be detected and compensated for during the grinding process.

By contrast, profile inserts are ground on the grinder in a production clamping system, which has an optimised geometry for efficient production. Usually, the insert is clamped across a much smaller diameter than the end product.

The geometry of the production clamping system is defined as follows:

Fig. 3: New type of clamping system

Three types of insert clamping systems are currently supported:
- Orientation of the insert in longitudinal axis direction
- Orientation of the insert parallel to the face plane (as shown in Fig. 2)
- Orientation of the insert perpendicular to the tip plane

The clamping system can be assigned to a 3D model that is visualised in the 3D simulation and, of course, monitored for collisions (e.g. as shown in Fig. 2). The insert itself is shown in the 3D simulation as a cube-shaped blank.

NUMROTO customers with the 'form cutter' and 'clamping system transformation' options can use this new function as of Version 3.7.0

Release Notes

The most important innovations between 3.7.0a and 3.8.0a

All relevant enhancements and improvements can be found at: www.numroto.com > Customer Area

General

Attachments
It is now possible to attach any kind of document to a NUMROTO tool. These files will then be saved together with the NUMROTO tool file in the NUMROTO database. It is also possible to open these files directly from NUMROTO.

XML-Import for grinding wheels
By using the XML import it is now possible to generate new wheels or new wheel packages directly in NUMROTO.

XML-Datainterface
Several additional parameters can now be imported or exported via XML.

Online help
New German online help file. Soon there will also be a complete new English help file available.

Intermediate positions
It is now possible to define up to 3 different positions for the pass over from one operation to the next. Afterwards it is possible to select for each operation of the operation sequence one of these positions for the pass over to the next operation.

Separate gash out angle for each group of teeth
The gash-out angle in the end-mill gash-out can now be programmed individually for each group of teeth. This can be used on the end-mill gash-out within end-mills, drills and form cutters.

End mills

New flute with constant land width
New flute calculation which will automatically keep a constant land width on the outside diameter.

Multi helix tools
The helix type differential helix can now also be used on multi helix tools.

Measurement in process
Improvements when using measurement in process for the diameter on a multi helix tool.

Drills

Clearance - variable width for the circular land
The rotation angle at the clearance operation can now be programmed as a data table. Like this it is for instance possible to get a variable width for the circular land.

Drill point subtype SE110 HPS
The new drill point subtype SE110 HPS has been added as part of the HP points. This is only available if the NUMROTO option HP points is present.

Form cutters

Flute form probing
Within form cutters the flute form can now be probed as an operation in the machining sequence (between two grinding operations). After the probing the measuring results will be used for the next operations.

Multi axis oscillation
Multi axis (up to 3 axis) oscillation for form reliefs in the direction of the relief surface (new NUMROTO option)

NUMROTO-Draw

Many new features have been added. For instance surface indication and manual dimensions.

NUMROTO-3D

Real time simulation
It is now possible the run the 3D simulation in real time (with the actual programmed feedrates). It is also possible to choose 2x, 5x or 10x real time speed. This new feature is part of the option 3D special functions.

Opening operations directly from NUMROTO-3D
It is now possible to open up a NUMROTO operation directly from NUMROTO-3D which then allows to change the parameters.

Collision check
If during the 3D collision check only the removal rate is exceeded the CNC program can now still be transferred after the warning message has been confirmed.

GrindTec 2014

GrindTec training offer
New versions of the NUMROTO software contain a lot of added-on and improved features. To use the full potential of NUMROTO, we recommend to have your employees trained on a regular basis.

We have a special offer for training courses until the end of May 2014. Please get in touch with our sales people at the GrindTec in Augsburg, or contact us by email (info@numroto.com) if you can not attend the fair personally.