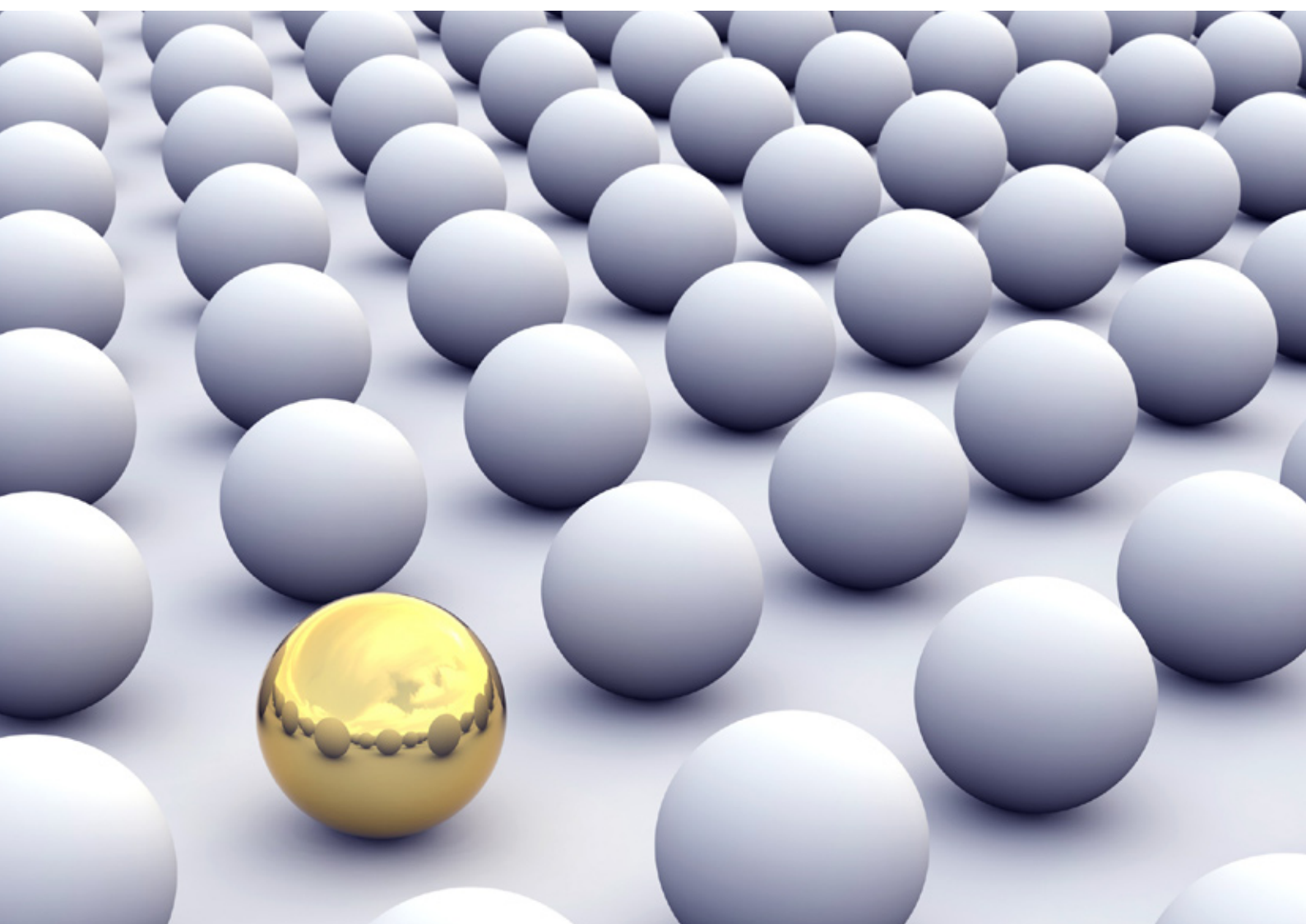


NUM

information

JOURNAL FOR CNC-TOTAL SOLUTIONS

No 50 – August 2010



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Words from our CEO

Dear readers,

"The only constant is change". This is how the editorial for the last NUM-Information no. 49 began. The market has been stirring, and in the process, market requirements have changed faster over the last few months than ever before. The crisis has also resulted in a new business environment for the machining and production industry. For the machining industry, it is important to approach the new circumstances positively and to turn them into strengths.

The continuous growth in market globalisation is making it increasingly important to develop a distinctive company profile and to communicate this accordingly. Just as every person is unique, every company is unique too. A considerable part of this uniqueness is characterised by the company staff and the company strategy.

NUM is a medium-sized company with branches worldwide. We are large enough to develop our products ourselves, and small enough to be able to adapt to any new challenges the customer and the market

building up know-how also has its limits, as a company we rely on our partner companies which have specialised in certain sectors. NUM has specialised in the automation of machines with special features. These

„Be unique – the recipe for future success“

(Peter von Rüti, President & CEO NUM Group)

present, both flexibly and quickly. Our know-how about the development of unique machines can be accessed in all NTCs (NUM branches) worldwide. Demands for increased productivity and more and more flexibility are being made of the machines. This heightens, in turn, the demands made of the mechanical engineers and their knowledge of diverse disciplines. However, because

special features can, for example, be in the productivity, operational, precision, or workpiece quality sectors, to name just a few. Thanks to the self-designed base products and the expertise of our staff, we are in a position to realise these unique machines in close cooperation with the machine manufacturer, without having to modify the base product itself. Any basic functions lacking can, when necessary, be integrated into the standard software immediately. This flexibility also applies for CNC, drives and HMI, of course.

We will be demonstrating our uniqueness to the visitors at the IMTS in Chicago, USA (13.09 to 18.09.2010) over an area of 83m² (900 square feet). Come and visit, and discuss your ideas with us. We are happy to help you make machines and products which are unique to the market!

Impressum

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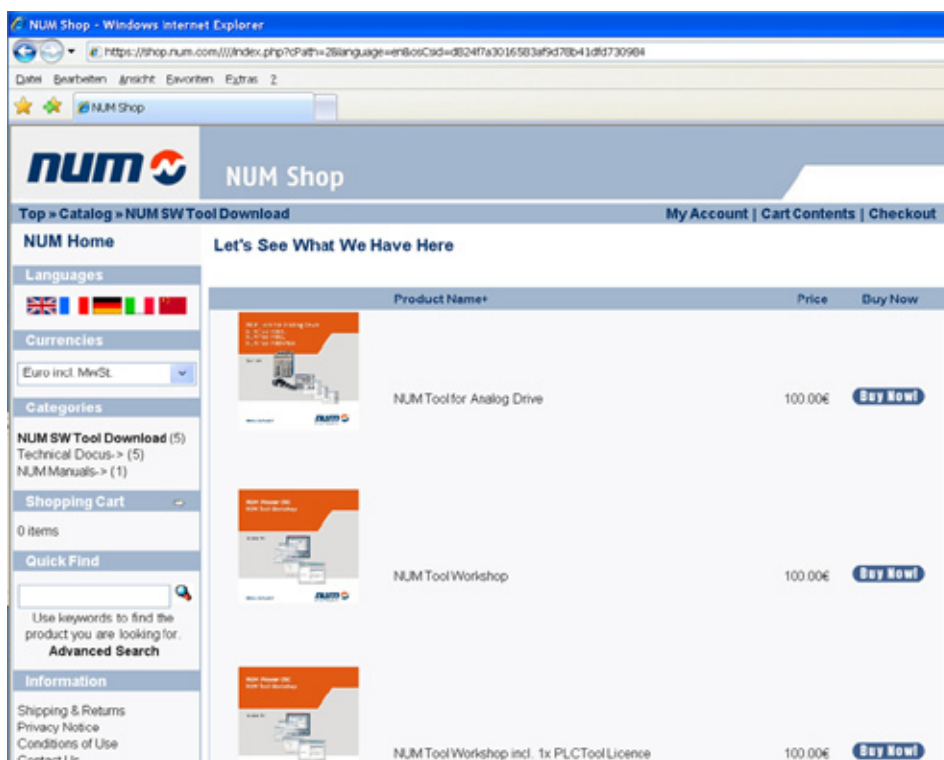
Peter von Rüti
President & CEO NUM Group

NUM Internet Shop Solution

In order to simply and quickly provide our customers with products at any time of day or night, NUM will be operating a shop in the Internet starting September 1, 2010.

The shop will support current NUM products which you can directly download to your PC. For example, to purchase a software tool you only need to log into the shop, place the software tool in the shopping cart and pay with a credit card. Within a few seconds you receive the download link with which you can then download the software tool.

Security and the strictly confidential handling of your data has top priority at NUM. To protect your data, we use only the most modern security standards. The entire shop, all personal data, and of course all data regarding payment are SSL encrypted for Internet transmission. Based on the needs of customers, the shop will in future also offer additional products not requiring sales consultation.



NUM Event Calendar



IMTS

From 13th – 18th September 2010 in Chicago, USA
Bouth No E-4936 in the East Building



Industry Lyon

From 5th – 8th April 2011 in Lyon, France



CIMT

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



Ligna

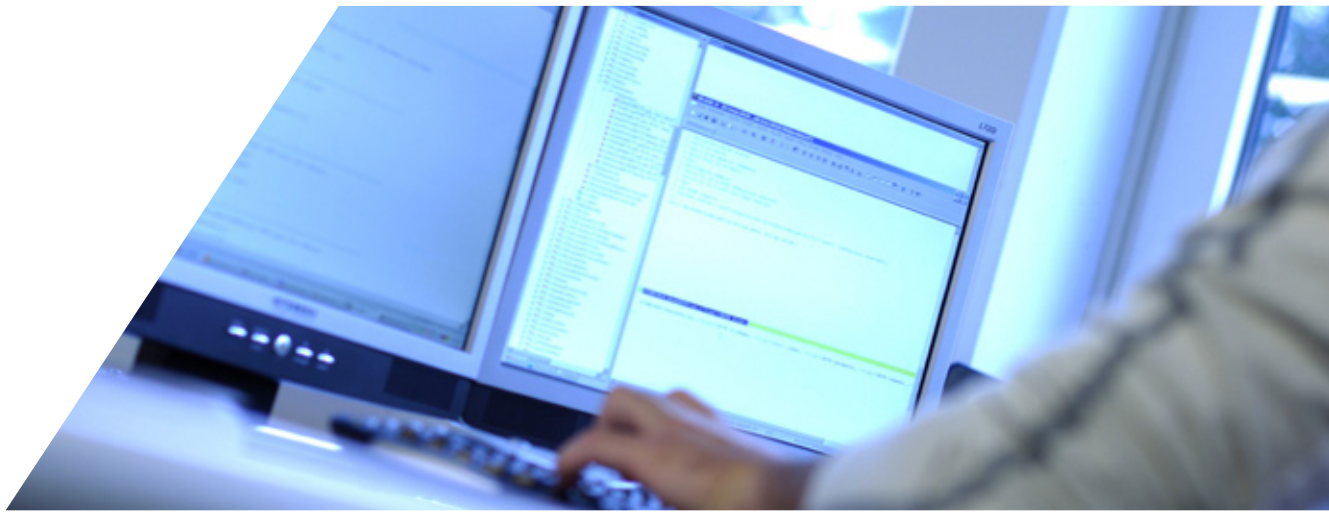
From 30st May – 3rd June 2011 in Hannover, Germany



EPMT

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

Events



Higher productivity by adapting the Flexium system to customer requirements

The Flexium CNC system contains numerous different options for adapting to the customer's needs. Depending on what training the development engineer has had in machine applications, the Flexium system offers ultra-modern tools and programming languages for creating sophisticated developments in the areas of PLC, visualisation, NC and contour programming, direct expansion of the CNC core, as well as application-oriented user interfaces. This article is written primarily for software developers working with machine applications and seeks to familiarise them with the programming and modification options as well as the advantages of the modern Flexium CNC system.

PLC programming in accordance with IEC 61131-3

Embedded in the Flexium Tools configuration and startup tool, which is based on CoDeSys V3.3, the developer accesses the actual machine and PLC applications through the device tree. With the aid of this PLC programming environment conforming to IEC61131-3, practically all software automation tasks can be accomplished.

IEC 61131-3 editors

The project planning level contains the CoDeSys programming system with all offline and online functions, editors, corresponding compilers and debuggers. All the editors defined in the standard are available to you for programming your control application: structured text (ST), sequential function chart (SFC), free graphical

continuous function chart (CFC), function block diagram (FBD), ladder diagram (LD), instruction list (IL) as well as optional supplementary object-oriented programming. Two programming versions should be considered more closely:

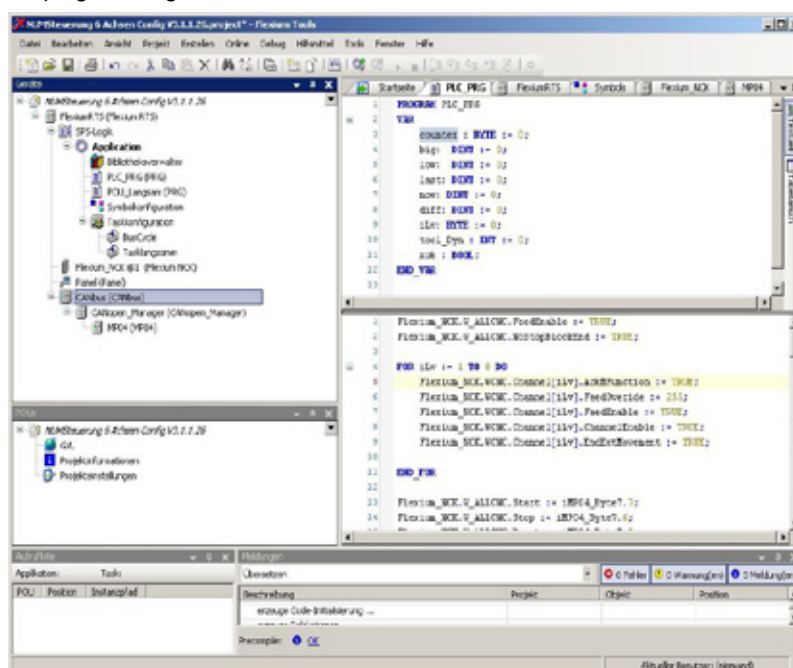
Structured Text (ST)

"Structured text" is a higher-level programming language, comparable to other high-level languages such as C or Pascal, which allows the development of complex algorithms. Ultimately, in addition to the machine sequence, the PLC program consists of structured instructions with case differentiation, comparisons, alternative programming, evaluation of logical and arithmetical expressions.

Object-oriented programming

With CoDeSys, you can also program your control in an object-oriented manner - conveniently and using constructs familiar from high-level languages such as JAVA or C++: classes, interfaces, methods, inheritance, polymorphy / dynamic linking. Object-oriented programming opens up enormous application advantages, such as the ability to reuse existing application components and to have simultaneous development by multiple programmers.

PLC programming environment in Flexium Tools



Debuggers, visualisation data types

```

76
77 oMPO4_Byte7[0].7FALSE := Flexium_NCK.RCNC.General.StartFALSE;
78 oMPO4_Byte7[0].6FALSE := Flexium_NCK.RCNC.General.StopFALSE;
79 oMPO4_Byte7[0].5FALSE := Flexium_NCK.RCNC.General.ResetFALSE;
80
81 (*
82 xok := Flexium_NCK.RCNC.General.CncReady;
83 *)
84 counter[35] := counter[35] + 1;
85 IF (counter[35] > 40) THEN
86   counter[35] := 0;
87   // usgang.7 := NOT(usgang.7);
88 END_IF

```

Integrated compilers

In CoDeSys, integrated compilers generate fast machine code from the control application. This makes optimal use of the performance of the programmed control. The compilers signal as soon as the program code is input: syntax errors, warnings and information on the application are output prior to the translation, ena-

bling the developer to respond to these immediately.

Debugging options

After loading the machine code generated from the application onto the target device, Flexium Tools offers numerous important functions for quickly and efficiently debugging your PLC applications and putting them

into operation. The current values of declared variables are shown in the program code (orange cells). These values can then be unproblematically modified or forced. By setting the breakpoints and then processing the program code - line by line - errors can be found quickly.

NC programming

For the NC program, Flexium offers all essential NC commands and cycles for grinding, lathing, milling, drilling, thread-cutting (inner/outer), laser and water-jet cutting as well as additional special applications, e.g. machining of wood or plastic and gear hobbing. The following arrangement in groups is given:

Axis/ISO programming

Axis programming is generally understood as the positioning of the major/rotational and minor axes in various channels in different reference systems. These can be programmed singly or as collective interpolations as well as axis pairs (synchronous, gantry, master/slave axes). The complete ISO instruction set (G, M, S, T, E, D) is implemented with NUM.

Contour programming

The Flexium system enables the user

to partially or completely program an existing workpiece contour made of geometric elements. Geometric elements are lines, circles and their connections. For multi-axis movements (3-5 axes machined simultaneously), linear as well as NURBS, spline and polynomial interpolation are available, for which the speed profiles (acceleration/braking) are programmable.

Parametric and symbolic programming

To construct NC programs with as much flexibility as possible, it is essential to use symbolic variable names (single and multi-dimensional fields) as well as efficient program constructs such as case differentiation, loops, arithmetical expressions and subroutines. Global variables (L-parameters and E-parameters) with variable and fixed definitions can likewise be selected. Symbolic fields or tables can assume the dimensions 1 through 4. All variables defined be-

tween VAR and ENDV are of the "Real" data type. Indexes of field calls can also be symbolically programmed. This enables mathematical parts of programs to be efficiently embedded in the NC program.

Custom-developed NC cycles

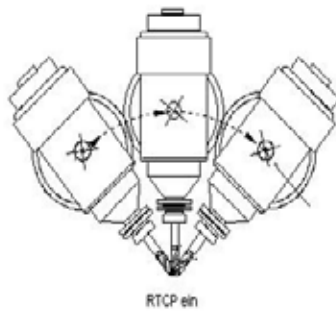
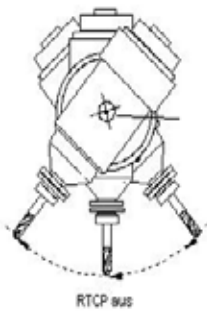
In addition to the available standard cycles for lathing and milling, customers also have the option of defining their own custom cycles. The G-numbers G100-G199 are provided for this purpose. These functions enable the calling up and executing of a subroutine with the numbers %10100 through %10199. If an already existing G-number is used, e.g. G81, the customer application has priority. This allows the creation of customer-specific variations of standard cycles.

Example of polynomial programming in X, Y and Z with time basis I

```

6 G01X92.846Y-96.383Z100.219F6000
7 I3.660 X94.578/0.156/2.275/ Y-94.651/0.156/2.274/ Z102.501/3.773/-0.750/
8 X108.543Y-80.686Z102.500
9 X115.791Y-73.438Z102.501
10 I3.978 X117.600/2.863/-0.219/ Y-71.629/2.863/-0.216/ Z100.000/0.175/-3.761/
11 X117.606Y-71.623Z99.685
12 I4.835 X120.193/0.298/4.046/ Y-69.036/0.303/4.031/ Z97.794/-5.012/1.724/
13 I2.246 X121.105/1.383/-0.311/ Y-68.124/1.380/-0.309/ Z99.525/0.951/1.100/
14 X121.142Y-68.087Z100.637
15 I18.044 X128.540/0.397/8.922/ Y-60.689/0.399/8.917/ Z113.913/18.171/-1.249/
16 I16.910 X139.315/11.448/1.936/ Y-49.914/11.449/1.933/ Z109.191/5.018/-10.924/
17 I2.685 X140.374/1.196/-0.121/ Y-48.855/1.195/-0.119/ Z106.965/-2.095/-0.123/
18 I7.253 X141.643/2.487/-1.215/ Y-47.586/2.490/ Z100.013/-6.351/-0.904/
19 X141.648Y-47.581Z99.558

```



Effect of RTCP function

RTCP transformation

RTCP (Rotating Tool Center Point) can be understood as the kinematic-dependent correction of the major axes positions (X, Y and Z) in the event that minor axes (A, B and C) are programmed, thus ensuring that the tool tip (TCP), regardless of its orientation, remains in the physically identical position on the workpiece. For all conventional machine kinematics in the 4- and 5-axis range, configuration interfaces are available in Flexium Tools for creating the transformation matrices for the kinematic correction movements.

Real-time programming

The dynamic operators allow the programmer (machine manufacturer) to modify the real-time core of the CNC control, without modifying the NUM firmware, whereby worldwide service is also possible for such special applications. Examples are overlapped axis movements or position-dependent output generation.

Dynamic operators always define various operations. These operations are used to perform quick links/calculations in the speed of the CNC cycle time. Such operators, arithmetic or trigonometric, loading and writing of CNC-internal axis positions and external E-parameters, overlapped movements, or the calling up of ISO or C programs etc., can be added as a part program of the CNC and executed behind the interpolators. The syntax for the use of dynamic operators begins with a leading "0" followed by the operation number "n". Operation numbers are 1 - 128. There are 24 predefined/ fixed operation types or operator functions; type 0 is the immediate cancellation of the operation.

Dynamic operators in the ISO program:

General example:
On = 2 Ea / Eb / Ec // equivalent to Ea = Eb - Ec
 On: Operation n is defined
 2: Dynamic operator 2 (subtraction)
 Ea / Eb / Ec: Operands (in this case E- parameters).
 The result is stored in Ea.

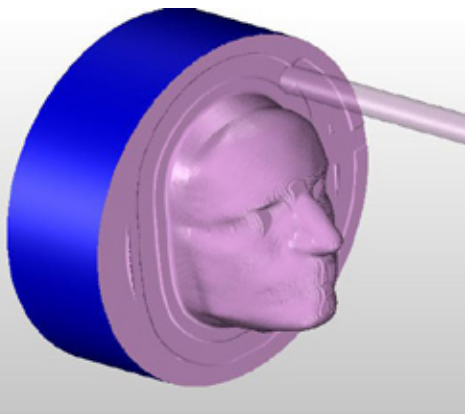
Dynamic operators in C

The options available in ISO programming are not suitable for displaying complex algorithms for the real-time environment of the NC core. For these applications, "dynamic operators in C" have been created. The developer formulates his calculation rules as a true C program. These C programs are first translated through the configuration in Flexium Tools, linked and then managed in the overall application of the RTE. The operator function 22 is reserved for the activation of dynamic operators in C. The formal syntax for calling up is as follows:

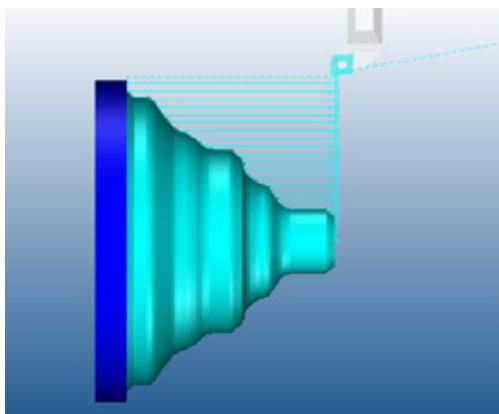
On = 22 COperatorName { P1/P2/... /Pn }

On: Operation n is defined
 22: Dynamic operator in C
 COperatorName: Operator-ID
 P1..Pn: Parameters and/or axis addresses

Milling simulation with material removal



Lathing simulation with traverse path analysis



3D simulation

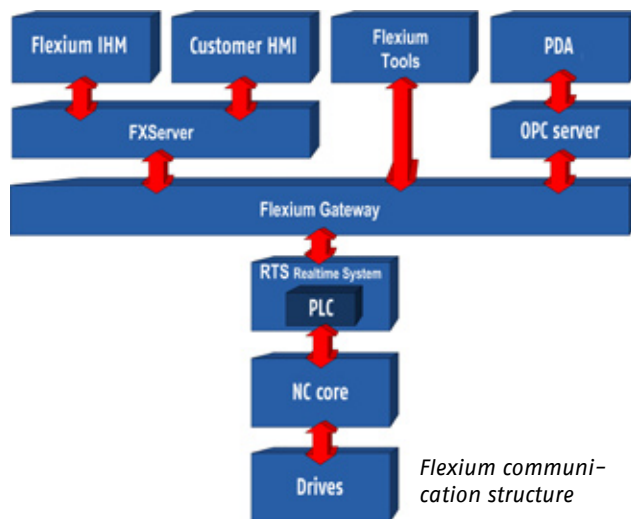
For the testing and validation of NC programs, 3D simulation is an available option. This tool simulates NC programs with the aid of "resource files" (such as machine models, tool lists, offset tables and machine parameters) in terms of the traverse paths, material removal and selective collision analysis. A great advantage lies in the ability to modify basic machine models to the respective kinematics with the aid of the integrated machine editor.

HMI programming

For customer-specific or application-dependent user interfaces, the Flexium system offers a software development kit for HMI programming. Based on HTML (static structuring of interfaces) and JavaScript (dynamic elements), both widely used and accepted languages, modifications or new interface screens can on the one hand be easily created or programmed. On the other hand, totally customised user interfaces (client developments) can be created with one's own preferred programming system (C++, C, VB, Visual C). For communication with the control components, a COM server is available to the FXServer.

Flexium communication overview

To be able to use certain components, the communication paths must first be briefly explained. On the HMI side, the Flexium user interfaces or a customer HMI is available. Both communicate with the RTS real-time environment of CoDeSys through the FXServer, Flexium Gateway. The CNC is connected with the RTS via a real-time Ethernet, ensuring that even control data and PLC information can be sent to PC clients fast and efficiently. Flexium Tools can be used to, among other things, program the PLC, create visualisations and perform parametrisation of drives and CNC-related data. PDA analysis can be handled through the supplied OPC server. The connection of decentralised HMI devices (Multi-Panel) is enabled through the same procedure HMI-FXServer-Gateway and an Ethernet network.



Flexium communication structure

process monitoring, camera functions or analysis programs. As programming language, C++, Visual C or other high-level languages are available.

Flexium FXServer

The FXServer plays a central role on the HMI side as COM server, which controls the bi-directional communication between the user interface software (HMI) and the PLC or the NC core through Gateway. Each PC application (client) is thus served, as well as the Flexium HMI of the COM classes of the FXServer, which is set up as a multi-client server. This offers fast and efficient interfaces for showing axis positions, CNC operating statuses, CNC memory capacity, and much more. The following diagram demonstrates the operation of the FXServer based on the example of "Read axis position".

PC-Client application: Flexium HMI or customer-specific HMI

Shown in the figure below is an interface screen of the Flexium HMI generated with HTML and JavaScript. This contains status information on the CNC at the top left. To the right of this is the area for system and user messages, current axis positions, spindle speed and feed rate displays as well as the vertical control panel on the right for switching context-dependent screens. The horizontal control panel at the bottom with individual buttons and popup menus offers functions for the respectively selected context menu. The inner (light-coloured) area of the mainframe can be modified for the customer.

Conclusion and outlook

From the standpoint of the developer, the Flexium system presents itself as open and easily adaptable to customer-specific requirements. It provides accessing options for all levels of the control: PLC, NC core, HMI, in real-time as well as from disconnected computers. The core for the development is beyond doubt Flexium Tools, offering configuration, programming, testing and archiving as a project file. This ensures that the application is always consistent and increases the benefits to the customer. It is NUM's strategic goal to develop its own process-relevant automation components. This enables NUM the freedom to adapt its products quickly to the continuously changing demands of the market. The Flexium system is also continuously updated with new functions for adapting to market requirements. Together with the numerous options for accessing and adapting that the system offers, it is ideally suited to today's market. All developments created are always made with the focus on designing the system to be as open and customer-friendly as possible.

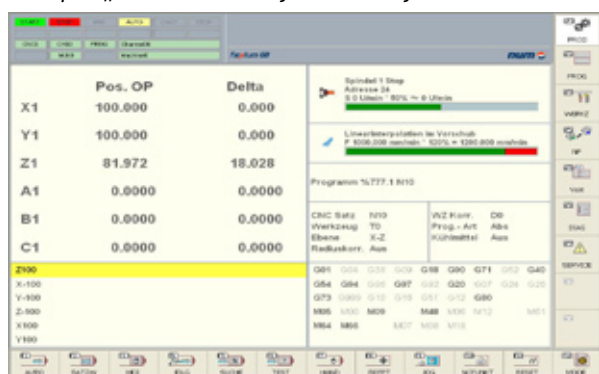
Extended CNC access

This feature can be understood as a supplementary library available to the PLC programmer for gaining reading and writing access from the PLC to selected data and information of the CNC. Representative for this PLC <-> CNC interface are axis positions as well as operating statuses and CNC functions.

ActiveX program link

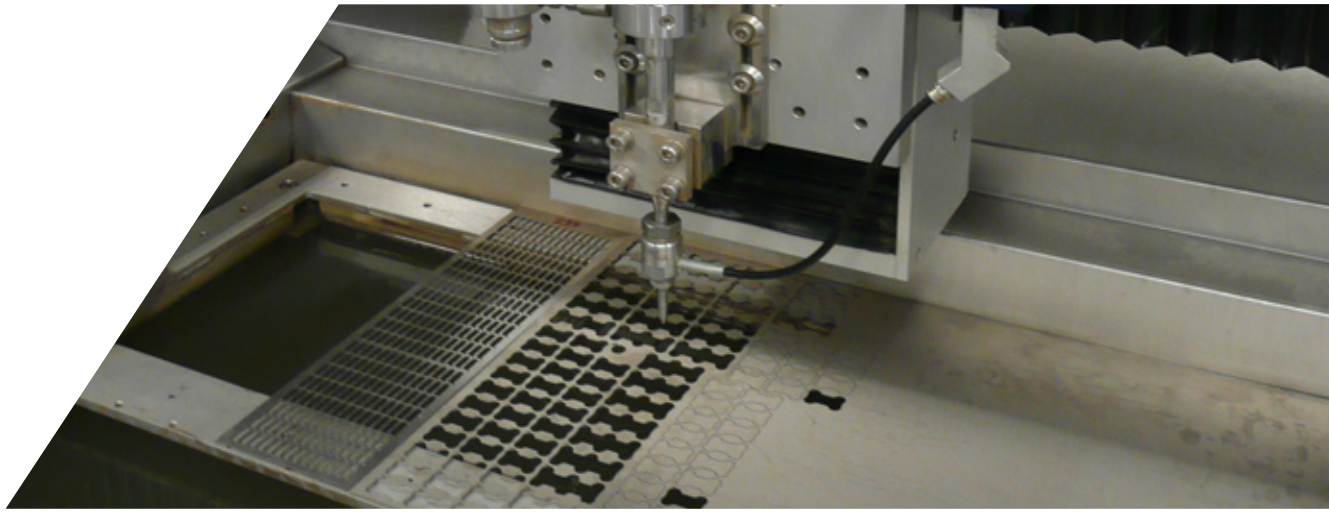
To use the HMI infrastructure of NUM, the framed area (grey area with verticle and horizontal control panels) in the Flexium HMI are fixedly specified. The inner, light-coloured portion ("mainframe") can be designed individually by the programmer. In the place of HTML code, the integration of an ActiveX component is also possible here, e.g. visualisations,

Example: „Production“ interface screen of the Flexium HMI



Example: Interface screen of the customer HMI





Water jet cutting, a technology on the rise

Steadily increasing requirements in regard to precision, ease of handling and the weight of individual components requires not only new materials and technologies but also a competent partner with whom these market demands can be met. With the CNC high-end specialists NUM, we at MDC Max Daetwyler AG have found this partner. Because the best way to predict the future is to create it.

The Daetwyler Group is a renowned medium-sized and second generation family-run business which has since 1951 had its headquarters in the Swiss midlands municipality of Bleienbach near Langenthal. Since its founding, Daetwyler has evolved as a precision machine builder and manufacturer of key components for a wide industrial spectrum. World-

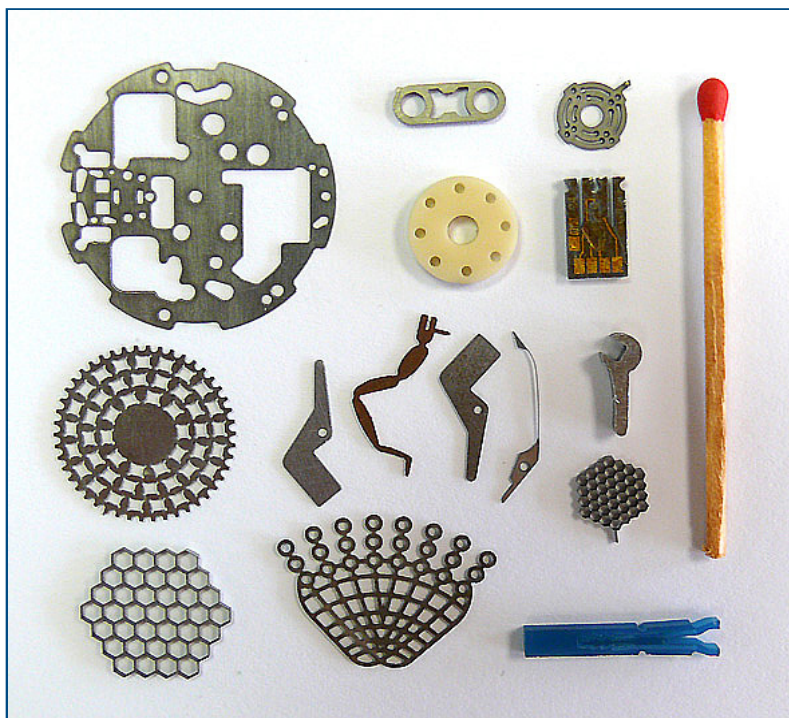
wide, the Daetwyler Group employs around 800 workers, of which about 150 reside in production locations in the USA, Estonia, China and India. In addition, the Group has access to an international partner and affiliate network in over 40 countries. Thanks to the global sales and service network, Daetwyler's extensive presence wins over custom-

ers. These production locations ensure that the company has the most important supply and distribution chains under its control in regard to target dates and quality and can thereby fulfil its responsibilities to its customers.

Daetwyler Industries and Waterjet AG, in collaboration with NUM, have invested heavily in research and development in the field of water jet cutting technology. This is because many new materials react negatively to the effects of heat during their machining. When processing with a water jet, the material structure remains unchanged. Practically all materials can be processed, even foodstuffs, providing they are not water soluble. The WOMAJET® / microWATERJET® machine opens up new possibilities. The process ensures a stable, reproducible and precision manufacturing process for the finest contours with land widths to 0.02 mm.

With water jet cutting, optimal results can be achieved. A high-precision water jet > 0.3 mm, controlled by a Flexium control unit made by NUM, consumes considerably less water and abrasives, and thus raises not only the quality but also the efficiency. The desire for products that are smaller, lighter, more stable, more easily handled etc. demands

A choice parts made water jet cutting, in the dimensions comparison





Beat Trösch, Head of Marketing + Sales, Daetwyler Industries (right)
Martin Grob, Director branch NUM Biel, NUM (left)



highly precise water jet >0.3mm

new manufacturing options. With the WOMAJET® / microWATERJET®, you have a tool that can implement the finest cut with the greatest accuracy, efficiency and process reliability in a conservative technique.

Water jet cutting has nearly unlimited areas of application. In medical technologies, biocompatible materials with complex part contours machined with high precision pose great challenges. The WOMAJET® / microWATERJET® meets these without changing the structure and with high process reliability. Resource-conserving mobility and the materials necessary for it such as Kevlar, carbon and glass fibres as well as hybrid materials, particularly in the automotive industry, demand innovative manufacturing processes such as the WOMAJET® / microWATERJET® offers. In the aircraft and

aerospace industries, water jet cutting processes can be used to machine heat-resistant, non-flammable, insulating, radiation absorbing composite materials such as laminate and structured materials without altering their characteristics. The WOMAJET® / microWATERJET® also combines high reproducibility and quality in the watch-making industry, currently celebrating a renaissance of the automatic, mechanical watch. Rigid, wear-resistant and even extravagant materials can also be used. With water jet cutting, even artistic elements can be precisely implemented. The cutting of artful, complex and unusual shapes or unconventional elements of combined materials can be creatively moulded.

At the IMTS, September 13–18, 2010 in Chicago, USA, the Daetwyler Group as well as NUM will be represented at a large stand to present the WOMAJET® / microWATERJET® water jet cutting machine to a wide public. The advantages of this trendsetting technology with its wide range of applications can thus be seen first-hand.

Innovation, precision and reliability – the values that gave “Made in Switzerland” its stature, will be proudly and diligently furthered by MDC Max Daetwyler AG. It is also these values which bind the Daetwyler Group and NUM, since both companies share the same the philosophy. Our customers know: Only high performance satisfies us, since that is the basis of both your and our success.

WOMAJET® / microWATERJET® at work



Precision

emotec ag

VBZ

Züri Linie

NUM
CNC HighEnd Applications



Making the old as good as new – thanks to retrofitting Increasing the efficiency of an underfloor wheel grinding machine through a new design

In the municipal transport services of the city of Zurich (VBZ), new types of trams have been recently introduced for daily use. The lower number of axles and smaller wheel diameters of the low-floor vehicles lead to higher loads on the wheels and thus to greater wear as in conventional rail vehicles. Worn wheel tyres could also lead to impaired riding comfort. Only through the mechanical reworking of the tyres (re-profiling) can this problem be remedied. VBZ and the company EMOTEC, in close collaboration with NUM, have come up with an innovative and reliable solution to get the wheels running true again.

Underfloor wheel grinding machine at the maintenance hangar of the municipal transport service of Zurich VBZ.



These wheelsets will be reworked in the VBZ maintenance hangar in Zurich-Oerlikon. With the 1991 under-floor machine of the Kellenberger company that was used previously, the wheels were ground through a form grinding wheel. This process is very time-consuming for heavier degrees of wear, since sometimes several millimetres of the tyre must be removed in order to bring the wheels to a uniform diameter. In addition, the upkeep of the nearly 20-year-old control unit could only be done at great expense.

The higher wear on the tram wheels requires greatly increased efficiency of wheelset machining and the manufacture of different profiles on the tyres. The VBZ trials first determined the fundamental feasibility of performing lathing on the existing grinding machines. Based on this, the Swiss company EMOTEC, in collaboration with VBZ, developed a concept for the enhancement of the machines with NC-

Axiom CNC with 16 axes



controlled turning attachments for precision turning. This construction enables a complete bogie with four wheels to be related or reground in a clamping. Working closely with NUM, a controller design was developed which also included the replacement of the existing control unit. The system also needed to be equipped with a modern control

Tram on the bogie of the machine





panel that would allow uncomplicated and reliable operation of the machine. The design features two Axium controllers with a total of 16 axes, two FSi-151 control panels and NUM's MDLU3 drive technology, which meet all these requirements. NUM developed the entire control and visualisation software. Such a machine retains the advantages of the grinding process while also meeting demands for performance and flexibility, since the wheels are trimmed before the grinding process or exclusively turned.

The advantages of turning are, above all, the clearly shorter machining times, primarily with heavily worn tyres, and re-profiling of the tyres including the flange and the back of the wheel. Other advantages include the option of machin-



Wheel machining in the grinding process

ing different tyre profiles without having to adapt the tools, as well as optimised turning processes for

roughing and finishing. It quickly becomes clear that, for such combined machining, high demands are placed on the control unit. Two completely different machining processes must be made operable in such a way that the machine operator is provided with clear procedures to ensure the production sequences are clearly understood.

Control panel for underfloor wheel grinding machine



For the success of this project, the use of modern materials for the tools, a machine construction based on the requirements, and not least of all the use of a powerful control unit with optimally set drives were instrumental. EMOTEC and NUM have demonstrated that the retrofitting of an existing machine using novel ideas can indeed compete with the purchase of a new machine. Experience the result first-hand when you take one of the many trams in the city of Zurich and enjoy a gentle ride.

Evolution



Ralf Fernandez (left) and Steven Schilling (right) NUM USA

22 years of quality time NUM in the United States

NUM Corporation has come a long way in the last 22 years. During all of this time, the company has operated under the guiding hand of Ralf Fernandez. This year, Ralf hands over the reigns of General Manager to Steven Schilling, so we asked both parties for their views on the past, present and future.



What key factors lie behind NUM Corporation's success?

Ralf Fernandez: "We started out with two basic goals in mind: to provide service support for NUM products imported in foreign machines, and to introduce NUM products to the North American market, where we were virtually unknown. Our business strategy has remained essentially unchanged: developing our strength around our competitor's weaknesses and taking full advantage of the inherent flexibility of NUM's products' in order to adapt rapidly to market conditions and to enhance the efficiency of machine tools.

We have focused much of our efforts on the requirements of small and medium sized OEM and retrofit /remanufacturing companies that address niche markets, such as gear manufacturing, cylindrical, surface and tool grinding. To this end, we provide cost-effective control solutions using built-in programs – macros – that address the requirements of the control process, combined with user-friendly human-machine interfaces – HMIs – to enhance the productivity of machine operators.

When examining the factors that have contributed the most to our success over the years, one stands out above the rest; namely, the talented and dedicated employees of NUM Corporation. Our competitors may have the quantity, but we, without doubt, have the quality."

Why was Steve Schilling selected as the next General Manager of NUM Corporation?

Ralf Fernandez: "Steve is ideally placed to be my successor. He has a solid engineering background – with a particular expertise in control systems – and during his 20 years with NUM Corporation has acquired extensive knowledge of our products and customers. Steve also has an excellent understanding of sales and marketing."

Where does NUM Corporation sit in the US market today?

Ralf Fernandez: "The American machine tool industry started a long and steep decline in 1998. Large and well-recognized machine tool companies that populated the American landscape have gone out of business. Due to bankruptcies, attrition

and mergers, the industry is now primarily populated with small and medium sized companies that build new machines, but also retrofit existing ones. Since this has been NUM Corporation's target market all along, we are in recognizable territory. And although we have also been affected by the severity of the market attrition, we are in a much better position than our competitors to weather the storm."

Where do you see NUM Corporation now focusing its activities?

Steven Schilling: "Due partly to overseas competition, North American manufacturing is no longer characterized by long production runs of identical products. Most manufacturing now involves short-run project times, engineer-to-order flexibility and highly regulated production. Consequently, we will continue to promote flexible NUM products paired with very creative personnel, to create solutions for these new market demands. Although we have had considerable success with our offerings for existing niche markets, we need to strengthen our position by contin-

ued product enhancement. We must also continue to be reactive to our customers' demands, using the valued experience of the end-user and the machine builder to cultivate product evolution.

With the Flexium CNC solution, NUM provides a control platform that can readily be adapted to customers' demands. While building upon our history of delivering complete high-end machine tool control solutions, the Flexium offers a fully customizable HMI, true 3-D simulation, and a flexible PLC architecture with IEC 61131 and Can Open interface. Combined with our exceptional product range, this provides us with the capability to strengthen our solution-based approach and to grow market share."

What are the keys to success in supporting existing customers and landing new business?

Steven Schilling: "We will continue to follow the path that has proven for years to be successful for NUM Corporation, which is bring our customers the highest possible value in a machine control partner. So we will continue to implement a targeted 'complete solutions' approach, while remaining focused on three key principles:

1. We will maintain our dedication towards complete product support and service to the machine builder/retro-fitter, as well as to the end-user.
2. We will continue to capitalize on the strengths of our product flexibility and our talented engineering

team, by providing full solutions for targeted markets.

3. With our high quality products, customer training and support services, we will help our customers reduce their cost of ownership on machines controlled by NUM, throughout the product's entire life-cycle.

Our full range of machine control products and our strategy of maximizing synergy with our partners, by offering NUM technical expertise where needed to complement the OEM's or integrator's engineering resources, gives the customer the freedom to adapt and prosper in the changing market. At the core we will remain a true partner with our customers, shoulder to shoulder, to deliver the most effective and efficient machine and control solutions."

American successes

NUM Corporation enjoys considerable success in the North American market. Here we take a brief look at three recent build-ins.

Anderson-Cook Machine Tool

Anderson-Cook Machine Tool is the world's leading manufacturer of spline-rolling machines and associated tools. Based in Fraser, Michigan, this company is a relatively new account for NUM Corporation, having first approached us in March 2009 for a CNC system for an innovative 3-axis precision grinding machine that it was developing. The machine was launched just three months later, and is already enjoying considerable market success.

Anderson-Cook's new C3-5-F AC-Tru precision grinding machine is capable of form grinding, plunge grinding and in-feed grinding, and features a built-in acoustic system for polishing to a high micro using carbide or steel. The machine incorporates a novel 'AC-Tru Centerless' grinding fixture, which can accommodate a very wide range of work-piece diameters, from 0.127 mm (0.005 in) to 139 mm (5.500 in).

The AC-Tru Grinder has three precision axes – a 558 mm (22 in) longitudinal table, a 203 mm (8 in) cross slide table and a 368 mm (14.5 in)

vertical column – each equipped with an AMO digital scale which provides 500 nanometre (20 millionths of an inch) accuracy. The two horizontal axes employ precision linear rails and are driven by high performance digital linear servomotors, which combine exceptionally high positional accuracy and repeatability with a very long service life. As standard, the AC-Tru Grinder is also equipped with a 5 hp professionally balanced spindle, controlled by a variable speed drive. The spindle can accommodate wheel diameters up to 30 cm (12 in) and can attain speeds up to 3,600 rpm – the equivalent of a linear speed in excess of 57 m/s (187 ft/s).

All three axes are controlled by a NUM Power CNC system, and the machine's HMI comprises a NUM FS15iCF operator's panel and an MP03 machine tool builder's panel, co-mounted on an articulated ergo arm. The NUMgear machine control software includes the NUMPass and PCProCAM packages for cylindrical grinding. The control flexibility of the AC-Tru Grinder's software enables the machine to handle a wide



Anderson-Cook's new AC-Tru Grinder tool grinding machine uses a 3-axis NUM Power CNC system

variety of grinding processes, including centre-less thru-feed and plunge, multi-plunge mixed with an oscillation cycle, OD profile, surface and creep feed.

According to Mike Vettraino, Grinding Product Manager, of Anderson-Cook Machine Tool, "The user interface of NUM's CNC software combines easy-to-understand graphics with straightforward parametric programming, making it highly intuitive. This helps to reduce the time and cost overheads of operator training, and enables our customers to bring the AC-Tru Grinder on-stream very quickly."

NUM USA



Bourn & Koch Machine Tool Company

One of NUM Corporation's very first customers, the Bourn & Koch Machine Tool Company is nowadays a highly valued business partner. Based in Rockford, Illinois, Bourn & Koch operates a large, 12,000 m² (130,000 square feet) purpose-built manufacturing facil-

ity, where it produces an extensive range of precision machine tool products. The company also rebuilds and remanufactures legacy machines, retrofitting many of them with NUM CNC systems to improve their performance.

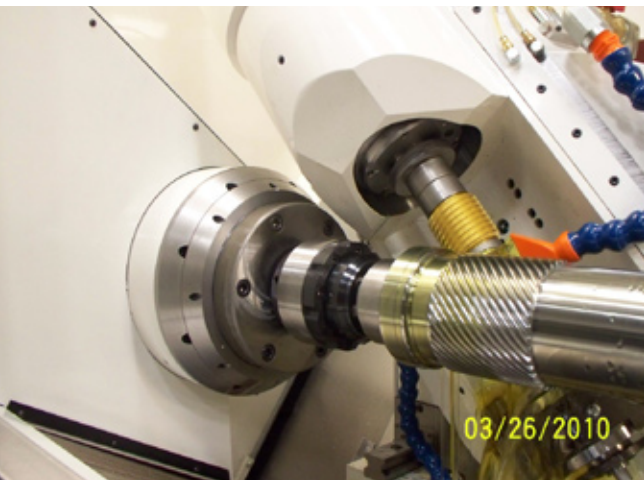
According to Loyd Koch, Vice President of Bourn & Koch, "We have been utilizing NUM controls in our products for over 20 years. The initial driving force was that NUM produced the only control system with an integral electronic gearbox that met our requirements for gear hobbing and grinding. Over the years, this usage has expanded to other parts of our business – including turning, milling, boring and grinding machines – due to the cost, support and complete product solutions offered by NUM Corporation."

Bourn & Koch's latest gear manufacturing machine – the 400H Series II horizontal gear hobber – is a highly advanced seven-axis CNC system capable of exceptionally high throughput. As standard, the machine is equipped with NUM's Axium Power CNC system and FS151iCF control panel – which features an integrated industrial PC – and makes extensive use of NUMDrive C compact servo drives and BPH series brushless axis motors with absolute feedback.

The supplied NUMgear software features a multilingual user interface, which provides Bourn & Koch with a significant competitive advantage for machines that are exported to other countries, and includes the NUMPass and PCProCAM packages for gear hob-



Bourn & Koch's 400H Series II gear hobber has seven CNC axes



The 400H gear hobber features a unique CNC servo-driven tailstock



bing. Custom hobbing screens enable multiple hobs to be used to produce cluster gears within the single setup; the CNC hob-shifting macros simply shifts from one tool to the next, while maintaining synchronization to the gear to allow for tooth line-up. The 400H series gear hobber can accommodate a work diameter of up to 400 mm (16 in) and features a unique CNC servo-driven tailstock. The tailstock can be programmed to have two pressures for each cycle; a high pressure is used initially, to embed the face drivers into the part, and then a lower pressure is used during the actual cutting operation, to prevent the drivers from going deeper into the part and causing a small amount of rotation that would show up as lead error when the gear is inspected. The NUM digital drive interface enables the tailstock motor's torque output to be adjusted on-the-fly, to provide programmable set points for the tailstock pressure.

Star Cutter Company

Founded in 1927, Star Cutter Company has grown to become a world leader in the cutting tool industry. Headquartered in Farmington Hills, Michigan, the company operates numerous product-specific manufacturing facilities throughout the state. Star Cutter chose to adopt NUM CNC hardware and NUMROToplus software for its latest tool and cutter grinding machine.

Star Cutter's new NTG tool and cutter grinder is designed for manufacturing and reconditioning complex cutting tools quickly and precisely. Typically, these tools would include end mills, drills, step drills, taps and form cutters. The NTG is a five-axis grinding machine – featuring a three-station wheel and manifold changer capable of switching grinding wheels within 10 to 15 seconds – complete with a fully integrated 3-axis automated loading and unloading stage. The high speed auto loader holds up to 288 parts, and can load and unload 12.7 mm (0.5 in) diameter, 200 mm (8 in) long tools to/from an automated tailstock centre in less than 15 seconds.

All eight machine axes are controlled by a single NUM CNC system. The machine also makes extensive use of NUMDrive C compact servo drives – their small size is an important advantage, because the NTG is designed to take up minimal floor space – and employs linear motors on two of its horizontal axes to maximize performance.

Linear motors on two horizontal axes eliminate the need for ball screws and reduce the number of moving parts, lowering maintenance costs and improving surface finishes. And, since the loader is integrated in the standard enclosure, the NTG takes up 30% less floor space than earlier generation machines. NUM's NUMROToplus software, designed specifically for tool production and re-sharpening tasks, enables the machine operator to easily check and optimize tool alignment via a graphical HMI.

Star Cutter will be exhibiting its new NTG tool and cutter grinder at IMTS 2010. Check out StarSU booth N-6924 in the North Building.



All 8 axes on Star Cutter Company's new NTG tool and cutter grinding machine are controlled by a single NUM CNC system

NUM Exhibiting at IMTS 2010 – Booth No E-4936

NUM will have a large 83 m2 (900 square feet) exhibition booth at this year's International Manufacturing Technology Show. Held every two years at the McCormick Place complex in Chicago, Illinois, IMTS is one of the largest industrial trade shows in the world. This year, the show runs from September 13 to 18.



We will be demonstrating a wide range of our CNC solutions for machining and tool grinding, including NUMgear, NUMgrind and other special products that we have developed for the North American markets. We will also be displaying our high performance servomotors and drives, innovative software tools and leading-edge HMIs. Pride of place will go to our latest Flexium CNC system, which provides manufacturers with a highly flexible and scalable means of maximizing their production of precision parts.

We look forward to welcoming you to IMTS 2010. We would be delighted to discuss how we can help improve the performance of your machine to provide you with a significant competitive edge in the market. Our exhibition booth – number E-4936 – is located in the center of the Controls & CAD-CAM Pavilion, in the East Building.



NUM USA



NUM Services – At your service worldwide

Consultation and support during the entire product life cycle. When you decide for a system and a solution from NUM, you are making a long-term investment. We consider ourselves to be your partner: from the idea to its realisation and through to on-site customer service

NUM's service concept is based on 3 pillars:

- **Training & Support**
- **Repairs & Upgrades**
- **Modernisation & Maintenance of value**

Training & Support

NUM is committed to transferring its know-how on a regular basis. In training courses, our specialists share their comprehensive CNC knowledge with you, as well as their special product expertise and drive and application techniques. Our extensive range of training courses is oriented towards your individual requirements, be these operator training, maintenance, repair and service training, or programming training in PLC, CNC, HMI etc.

Repairs & Upgrades – NUM Decades of support

Good, quick customer service ensures that waiting time is kept to an absolute minimum. Thanks to its new logistics structure and its 32 international service points, NUM is constantly working to reduce response times. Our specialists use their knowledge and skills to restore even older systems as quickly as possible – new or old, we are on the job.

NUM boasts a global, high-performance network of service points and branch offices. The tried-and-tested 3-level concept is structured as follows:

NTC: Num Technology Center – Competence centre with its own replacement part store

Agent: Independent NUM partner company with a local replacement part store. Support and regular training by our specialists

Contact: Local contact person for our customers, who speaks the respective national language

Replacement part supply

Thanks to our national representatives and partners, replacement parts can be supplied the quickest way possible. Local warehousing of every NTC allows the duration of replacement part delivery to be minimised. The local replacement part store is replenished by the large central warehouse, from which all NTCs and agents are served. We can produce and dispatch axis motors within 3 working days. NUM also offers a trade-off program for most replacement parts with a cost advantage of up to 40% when a part which can be repaired is sent back. Customers gain even more security with a Service contract. This guarantees the availability of parts in the NUM branches, allowing for the CNC systems the user has installed.



Remote diagnosis and maintenance

Our service engineers can make a remote diagnosis online via the HMI (NUMpass or NUMROTO) – simpler problems can be rectified directly, or bridged provisionally. This means you have no call-out costs. Even in the event of a more serious accident, time can be saved, as the maintenance personnel can begin to take the necessary measures even before the NUM technician is on location. In addition, any necessary replacement parts can be immediately sent or ordered.



Technical Service Hotline

Our hotline is staffed by well-trained engineers who can answer technical questions competently. The preliminary diagnosis made on the telephone determines the further procedure for the service staff and whether a service engineer will be deployed to the site. The technical service hotline can be reached every day during normal working hours, and this, thanks to our global service network, in most important time zones all over the world.

Minimising waiting time by securing data

When valuable information such as commissioning data, PLC programs or CNC processing programs can be lost, recovering/replacing lost data can take longer and cost more than repairing the hardware. This is why our technical team offers special advice in terms of data backup.

Easy Backup

Easy backup is the simple and quick backup & recovery solution. With this software, images from individual partitions or entire data carriers can, directly and without any complicated installation, be generated on the Easy Backup USB stick. Should Windows suddenly no longer be able to run, a data carrier image is always readily available for this emergency.

Backup Agent

This optional backup software, which is integrated into NUMpass, allows you to configure which items should be backed up. The backup occurs manually or fully automatically, depending on the setting.

Software updates and extensions

The ongoing development of the CNC system software and new hardware components for our control family enhances the practical potential and capabilities of CNC. The developments made in the NUM laboratories include user benefits such as new functions in programming and operating environment. Thanks to years of experience in practice, new tools emerge which support the machine manufacturer and the user when solving problems.

Audits

A further form of customer service is represented by the audits NUM can perform. To provide customers with the greatest possible security, the machines are carefully checked by our NUM technicians. The completeness of the replacement part store is

also checked, and attention is called to any parts missing. Know-how is significant for every company. NUM therefore develops individual training plans, based on the latest level of knowledge, together with the customer. These are then implemented in accordance with the customer's specifications. The customer is therefore optimally prepared should a glitch occur and it can be ensured that the machine is being operated correctly.

Service contracts

The NUM service contracts are aimed at end users, machine manufacturers and distributors. First and foremost, the service contract covers the labour and travel costs for potential repairs at the user's premises during the guarantee period; further main points are:

- Detailed telephone support
- Preferential support
- On-site support
- Increased availability of replacement parts
- Staff deployment



Modernisation & Maintenance of value

Older machines tend to suffer from failure of the electronics, and their reliability decreases from year to year. Compared to new machines, it is often the flexibility of the program and the CNC system that leave a lot to be desired. This is compounded by the no-longer-adequate computer and servodrive power.



Retrofit – extra service life for the machine

If the machine's mechanics are still flawless or the machine is one of a kind, which cannot be replaced by more recent methods, then a retrofit is an attractive solution. NUM is able to extend the service life of these machines, which is especially interesting from an economic perspective:

- Investing in a Retrofit pays off in a very short period of time.
- The Retrofit machine is up and running again in only a few weeks.



Our specialists finely tune the elements to one another and on the machine to combine perfection in precision and efficiency even for demanding procedures. The simple operation of NUM CNC systems ensures that this performance really can be achieved. The NUM customer service is also guaranteed for retrofit machines for years to come.

NUM customers can rely on optimal service for their control unit even after 20 years. Our NUM customer service works on this daily, as satisfied customers are the best business card our company can provide.

NUM Service



NUMROTO at core of Unimerco's seamless global tool manufacturing operation

Unimerco has earned one of the most interesting reputations worldwide for creating special-purpose tools. Its development services are heavily relied on by many of its end users to work with them to design better metalworking production solutions, and the company often produces custom cutting tools at extremely short notice. Underpinning Unimerco's special tooling services, with 12 facilities worldwide, is a very close relationship with its tool grinding machinery builder Sacke, and standardization on the tool grinding software package NUMROTO – the company's key resource when developing and prototyping new special tooling.

This theme of uniform excellence runs deep within the company's culture. Every Unimerco facility looks very similar, not just from the outside but also from the internal building layout. All employ-



ees, no matter whether they are manager, engineer, or machinist on the production line, works in the same unified space – there is no separation between office and manufacturing areas. Everyone is treated equally in these open-plan environments, with the CEO having the same workspace as the secretary, the designer, the engineer or the apprentice. And the company is also majority owned by its employees. This culture has enormous benefits in terms of communication efficiency and team spirit, and Unimerco has an enviable reputation for retaining highly skilled staff. Another unusual feature of the company culture is a small "hotel" area on major Unimerco sites with some 10-20 rooms and living spaces. This makes it very easy for the company to transfer employees for training and knowledge exchange, and to host major meetings for tool development, machine handovers, and training with both its clients and suppliers such as NUM and Sacke.

Tool development

Unimerco has been in the tool supply business for over 40 years, and moved into the creation of special-purpose tools some 20 years ago, following the acquisition of its own CNC grinding machines for reconditioning tools. Customization of tool designs to improve cycle time and eliminate process stages was the natural next step, and the company has steadily developed its know-how in this sector. This is aided by its unique corporate culture which means that many employees stay with the company for very long periods – allowing enormous experience to be brought to bear on any production requirement. Once accepted, the final tool specification is stored on a master server at Unimerco's Danish headquarters, allowing it to be accessed over the company's intranet by any subsidiary. Each of Unimerco's manufacturing locations in the Americas and Europe (and soon Asia) uses identical Sacke grinding machines, controlled by the identical NUMROTO pack-



from left to right: Walter Grob, NUMROTO Head of Sales, Gerd Hotz, SAACKE Director Marketing & Sales, Jorgen Bylov, UNIMERCO Group Production Director, Carsten Thomsen, UNIMERCO CNC Grinding Specialist, Finn Hassing, UNIMERCO Group IT Manager and Ib MUNK Nissen, UNIMERCO Technology Development

age used in the design – with the exception of local-language differences in the HMI. This means that Unimerco is able to faithfully reproduce every tiny aspect of the tooling design exactly as first conceived – wherever and whenever either new parts or regrinding is required.

Unimerco's focus on custom tooling typically involves the solving of complex problems, and this in turn has led the company to develop very close relationships with the grinding machine builder Saacke and the grinding software supplier NUM. Numerous major developments to the CNC technology inside Saacke's grinding centers can trace their beginnings to requests for new levels

of machining performance from Unimerco. Examples include the very first automatic Tool changer on a tool grinder or the unique network architecture. Likewise, Unimerco relies on a sophisticated tool design and machine control software, and standardized on NUMROTO in 1994. The package's comprehensive three-dimensional modeling, simulation and optimization environment plays a crucial role in Unimerco's ability to turn new designs around rapidly. If Unimerco has encountered a similar problem before (and the

sheer length of its experience over 20 years means that this is usually the case) then a template design typically exists in its model library. This means that many special-purpose tool designs can be imported, modified, simulated and optimized all within the space of an hour or so. NUMROTO's rich virtual prototyping facilities includes both workpiece simulation and collision monitoring for the Saacke grinding machines, helping Unimerco to build plenty of time into the development cycle for trials and customer evaluations.

Tools to boost productivity in hydraulics parts

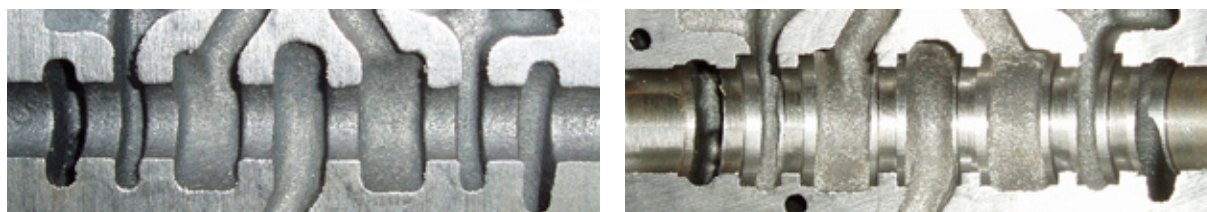
One of numerous industrial application areas that Unimerco is heavily engaged in is special tooling for machining hydraulic valve bodies. It's a sector that is characterised by a need for ever more complex solutions, and many machining contractors have found that close relationships with the tool developer holds the key to meeting these demands. Unimerco has developed a range of tool concepts for this market which can be easily and quickly customized for individual applications. One example is its land grooving tool, which can machine all the



UNIMERCO Grooving Land $N=1990t/min$ $F_n=0,06\text{ mm/rev}$.

lands in a spool bore in a single operation. Some machinists working in this market can use a cutter with inserts, and would typically have to machine the valve body in several operations with different tools, and maybe from both sides. With up to as perhaps 15 lands in a bore, the time and cost savings of optimized all-in-one solutions can be enormous.

Complete tooling package for the machining of a cast iron valve body
Unimerco has equally advanced solutions for other common valve body machining tasks such as holes for compensators, oil, shock valves, etc. Unique know-how embodied in its designs means that its tooling solutions also ensure that bores are created "ring free" – and do not require subsequent finishing operations after the initial machining stage.



A typical example of an efficient Unimerco all-in-one solution – a land grooving tool and the before and after results of a machined workpiece

Special tooling

CNC Complete Solutions Worldwide



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

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

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