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CNC4you

Practical knowledge
for the shopfloor

2/2016

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Siemens AG



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Digitalization: hype or opportunity?

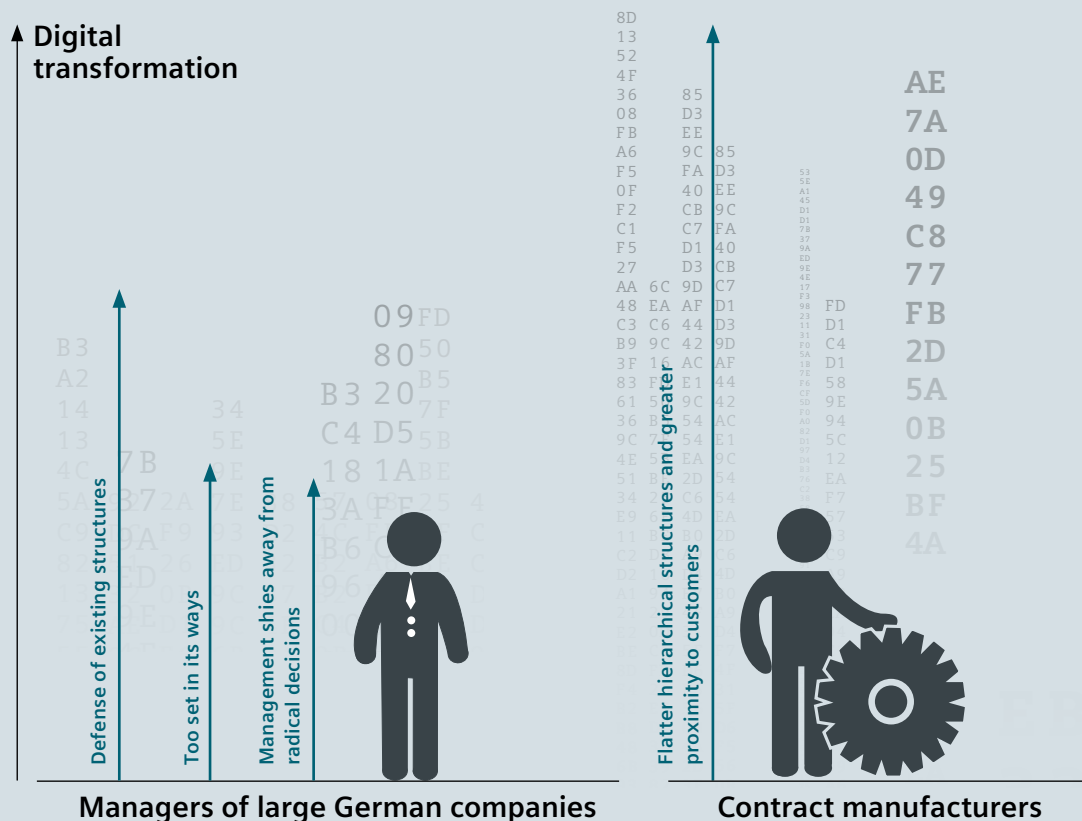
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Digitalization

Digitalization is the hot topic in every company — or so people think. The Nuremberg-based market research center GfK and the management consultancy company etventure surveyed managers from 2,000 large German companies (with revenues greater than €250 million) about the state of digital transformation in their companies. The results are very different from the image depicted by company representatives who talk enthusiastically about Industrie 4.0 and digitalization on TV and in the press.

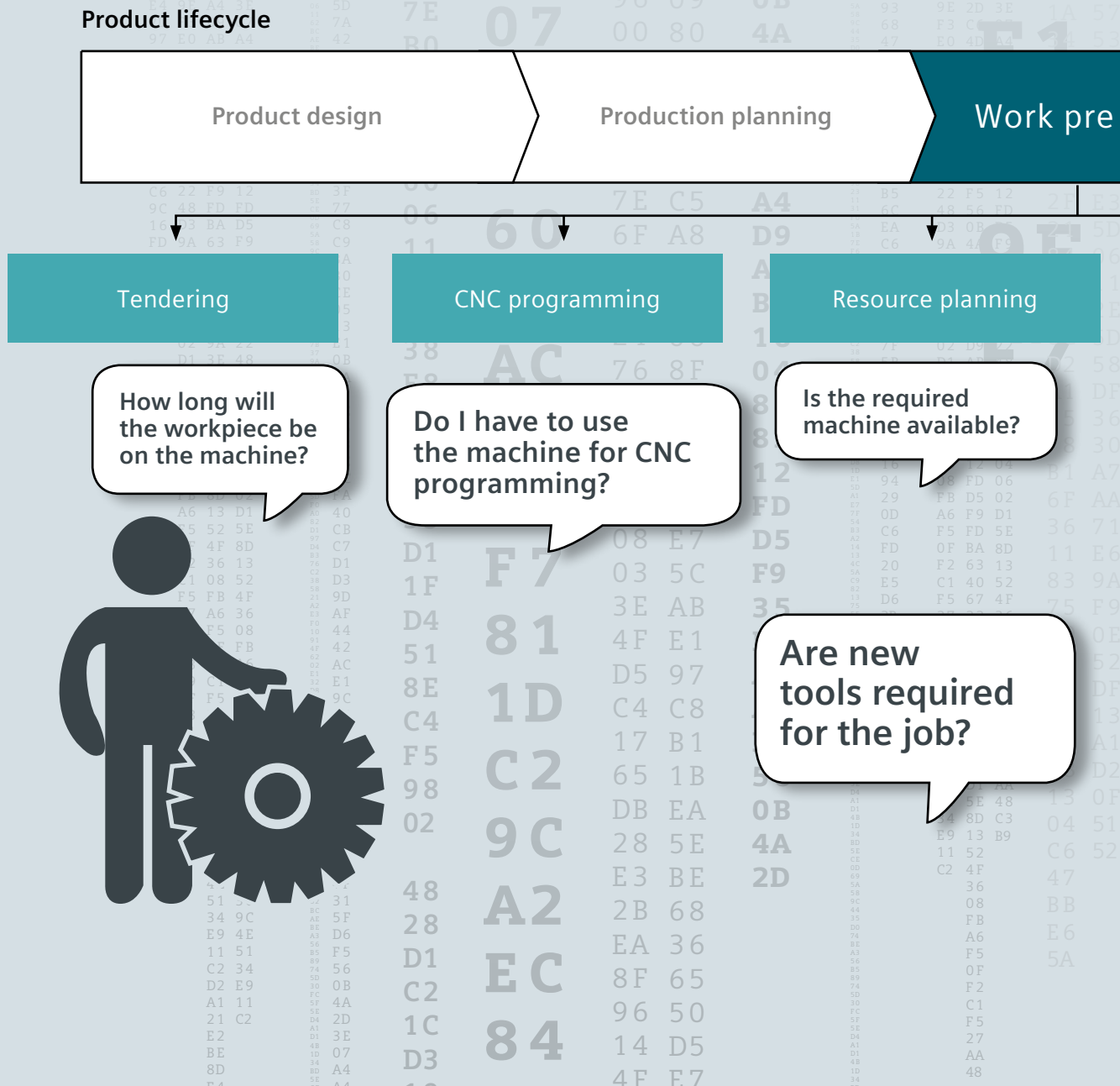
Specifically, 65% of those surveyed consider “the defense of existing structures” to be the biggest obstacle, 42% believe their own company is “too set in its ways” and 40% believe “management shies away from radical decisions.” In other words, many large companies are themselves getting in the way of their own digitalization and process innovations — despite the fact that they also expect great benefits from digitalization.

The picture is very different for small companies. They are better prepared for digital change thanks to flatter hierarchical structures and a greater proximity to customers. What does this mean for CNC contract manufacturers? If new technologies are implemented in a targeted manner, businesses with the courage to embrace change will very quickly recognize the opportunities digitalization brings.



Digitalization from the perspective of job shops

Digitalization and the increasing flexibility of value-creation processes are wide-ranging topics that entire books have been written about. But what aspects are relevant for contract CNC manufacturing? Where and how can today's manufacturing companies get started with digitalization? And how is it altering the work of CNC specialists?



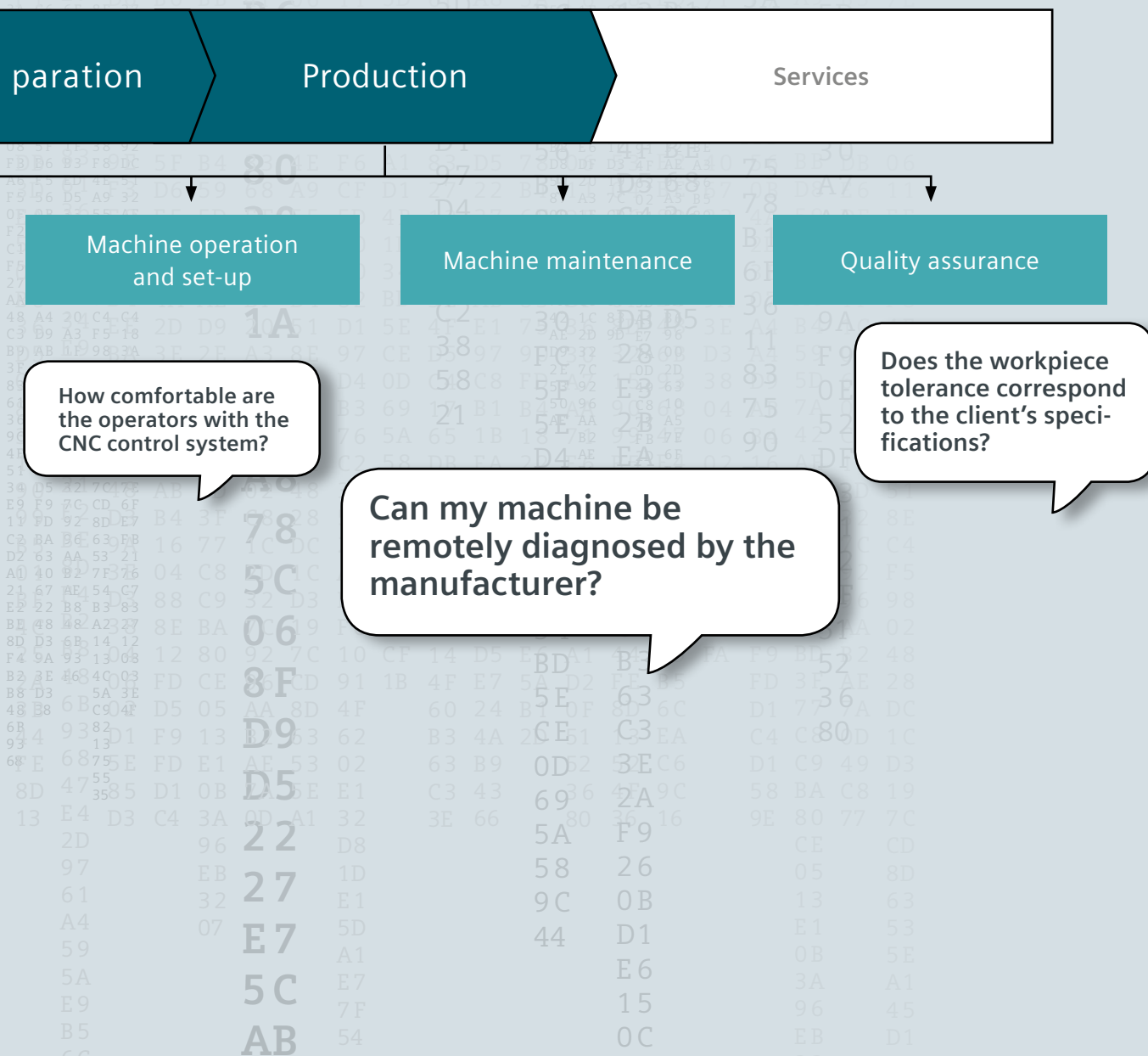
In the future, Industrie 4.0 and digitalization of industrial processes will encompass every step of the product lifecycle — from design to manufacture, service and maintenance. However, as production service providers, contract CNC manufacturers are generally involved in only a small part of this product lifecycle. Product design and services are generally the client's responsibility. Even comprehensive production planning is not an area of focus for many small and medium-sized firms. Instead, work is almost always performed "on demand." For contract CNC manufacturers, therefore,

digitalization tasks primarily arise in work preparation and production itself or in machining using machine tools.

Work preparation and production can be broken down further into additional process steps, ranging from tendering to quality assurance. The demand for digitalization solutions, and the current supply of solutions involving Sinumerik CNCs, can be illustrated using the typical questions that contract CNC manufacturing companies ask themselves when it comes to each of these process steps.

A perfect solution for everyone

It is not easy to link up the many issues surrounding digitalization with company-specific requirements and to find the right solution according to the contract manufacturer. However, the possibilities highlighted here may provide initial suggestions. The good news is that digitalization can be implemented step by step. The pace and order of implementation should be in harmony with the company's requirements and resources. Those planning specific investments in production should integrate digitalization and the efficiencies that it brings into planning from the beginning. ■ ➤



It is primarily the unit costs and the delivery deadline or throughput time that must be determined in order to be able to tender for a job correctly. Digitalization is helpful in this area. Today, the amount of time a workpiece will require for machining can be calculated quickly, reliably and — most importantly — without trial runs using CNC simulation solutions. The Sinutrain offline operating and programming software for PCs, which is identical to real control systems, supplies the appropriate information for work preparation. This is based on a virtual Sinumerik NC software kernel (VNCK) that behaves in exactly the same way as the real Sinumerik in the machine.



How long will the workpiece be on the machine?

To gain an overview of machine performance and utilization, operators can consult OEE (overall equipment efficiency) indicators, which are read out from the CNC. For example, the workpiece count, program runtime, current workpiece program or machine utilization can be displayed on a PC or mobile data device using the ncTOUCH software from Sinumerik solution partner Mill IT. Production managers can use these data to assess the availability of the relevant machine. If OEE indicators are already assigned to specific orders, Analyze MyPerformance from the Sinumerik Integrate software suite should be used. This function allows operators to assign their workpieces to specific orders within higher-level order systems directly via the Sinumerik operator interface. It allows them to find out the exact status of an order online during a shift. Thanks to this transparency — along with any automatic warning signals — they can respond quickly to machine malfunctions and shift the production of urgently needed parts to another machine.



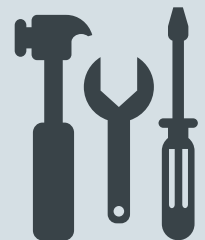
Is the required machine available?

Graphical programming on the machine is definitely an option for simpler individual workpieces. However, in the future, companies will favor offline programming for more complex workpieces or to increase the output of the machinery and make production more flexible. Here again, the Sinutrain operating and programming system is perfect as an entry-level solution. A solution with an integrated CAD/CAM-CNC process chain is even more efficient. Siemens offers NX, a CAD/CAM system that can be perfectly adapted to work with Sinumerik and that guarantees maximum process reliability thanks to its use of the virtual CNC kernel. For machines from some manufacturers, this CAD/CAM-CNC process chain is even available as a digital twin to the real machine.



Do I have to use the machine for CNC programming?

One key factor in resource planning for CNC production is tool availability. The installation of suitable software can provide a real-time overview of availability and prevent time-consuming searching during production. ncTOUCH makes it possible to bring up the current assignment of individual machines' tool magazines. This allows the user to immediately see whether the required tools are in the desired machine. Manage MyTools from the Sinumerik Integrate software suite goes even further. This function makes it possible to quickly and reliably compare tool requirements for specific manufacturing jobs with stocks of tools throughout the factory. The tool requirement lists are then automatically sent to the tool setting device, and the identified geometric data are sent to the CNC's tool offset memory. If there are any tool shortages, the data are immediately forwarded to higher-level ordering systems.



Are new tools required for the job?

Users have long become used to the digital world when it comes to private means of communication. A similar look and feel in the control system makes for easy CNC operation. Sinumerik Operate is a user-friendly operator interface that is based heavily on the operating philosophy of PCs. In addition, thanks to smartOperate, the gesture-based operation that users are familiar with from smartphones and tablets is now available on the machine.



How comfortable are the operators with the CNC control system?

In the future, in addition to being assessed, component accuracy will need to be reliably logged for quality assurance. Sinumerik CNCs already offer a comprehensive package of measuring cycles for determining component geometries during the machining process. These process-measurement results for the machine can now also be stored directly on a server in CSV format, and the data can be further processed automatically.



Does the workpiece tolerance correspond to the client's specifications?

Diagnostics and maintenance are critical when it comes to complex industrial products such as machine tools. Thanks to networking, telemaintenance makes it possible for companies and manufacturers to minimize maintenance times and increase productivity. In the simplest cases, fault signals from the machine, the entire Sinumerik operator interface or images from a camera integrated into the machine can be brought up on a PC or mobile data device using ncTOUCH. This allows in-house technicians to prepare effectively for their maintenance work. If the machine manufacturer's service staff need to access data on the machine or CNC externally, this immediately raises the question of data security. Sinumerik Access MyMachine facilitates CNC telediagnosics over the Internet and meets the IT security requirements of the German Federal Office for Information Security (BSI). This makes it considerably easier to obtain consent from the IT departments and IT security officers of the manufacturing companies. Sinumerik Analyze MyCondition allows the monitoring of machine status, with the machine raising the alarm in the event of a fault. This shortens the time required for diagnostics and minimizes serious consequences such as unforeseen machine downtimes and major damage. It also means that maintenance work can be carried out proactively, eliminating unnecessary periods of machine downtime.



Can my machine be remotely diagnosed by the manufacturer?

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Perfect surface finishes

Top Surface creates even surfaces regardless of the CAM output data quality.

The Advanced Surface intelligent path control in Sinumerik MDynamics has been extended: Top Surface ensures the highest surface quality in mold and die production. This function optimizes the data from the CAM system

for the subsequent Sinumerik path control, which results in improved compensation for inexact data. ■

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Best surface quality

- Elimination of irregularities from CAD/CAM data
- Identical smoothing of the milling paths independent of direction

Stable milling machines

- Significantly quieter machine operation
- Reduced wear
- Increased long-term availability

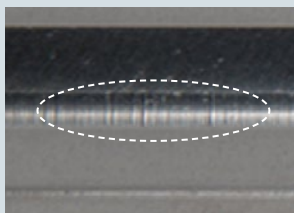
Improved accuracy

“Smoothing” function

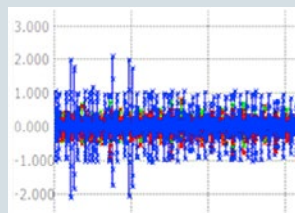
- ON: best surface quality
- OFF: smallest structures

Perfect usability

- Simple graphical operating screens
- Optimum surface quality, even with standard settings (for most NC programs)



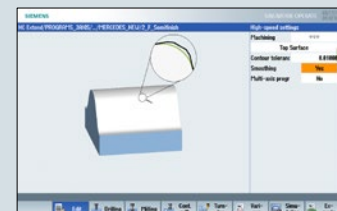
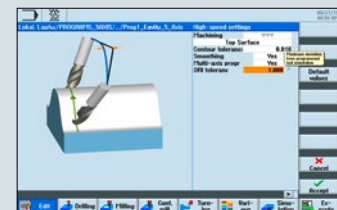
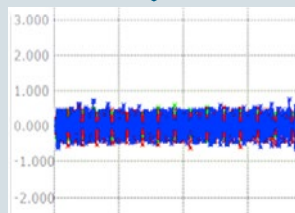
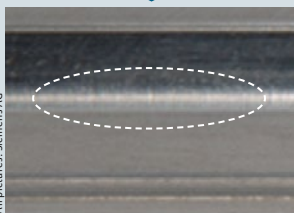
with Top Surface



with Top Surface



Smoothing OFF





Complex tasks?
No problem

CNC programmers increasingly face special tasks that take them to the limits of classic (DIN 66025) and graphical CNC programming. CNC high-level programming language with Sinumerik provides valuable support in this area.

Special tasks in CNC programming are common. Whether it be configurable CNC programs for component families that differ only in a few geometric sizes, certain components that require their own technology cycle because not all special tasks can be handled using standard cycles or a simple operator message to be generated from an ongoing CNC program that cannot be fully implemented using the instruction set offered by DIN 66025 or graphical CNC programming (e.g., ShopMill or ShopTurn), using a CNC high-level language offers new ways to respond quickly and flexibly.

Benefits of high-level languages

Unlike hardware-dependent assembler programming, high-level computer languages can be used to model complex program sequences in an easily readable format — that is, very transparently. This also applies to CNC programming. CNC high-level language complements machine-dependent DIN 66025 programming (G00, G01, G02, ...). In the CNC market, the Sinumerik high-level programming language offers fundamental properties of third-generation high-level computer languages such as C, C++, Visual Basic, Pascal or Java. In practice this means that it is possible to significantly increase the flex-

ibility of CNC machining programs, allowing CNC programmers to implement challenging CNC applications.

Typical properties of high-level programming languages

A key prerequisite for programming using high-level languages is commands that are readable (“mnemonic”) for the programmer, such as REPEAT, WHILE, CASE, etc. In addition, the programmer defines which variables are used in the program and which variable types they are to be assigned to. The variable type defines whether the variable should contain an axis position (floating-point number, type: REAL), a counter (whole number, type: INTEGER) or the result of a comparison (type: BOOLEAN). Control structures, such as conditional branches (IF, ELSE) or iteration loops (WHILE, REPEAT UNTIL), are also important for the mapping of the program sequence. Beyond the basic forms of calculation, high-level languages additionally offer higher-order mathematical functions, such as sine/cosine or a logarithm function. The operational scope also covers Boolean algebra, with functions such as AND, OR and NOT.

Easy to prepare with flow diagrams

When it comes to complex tasks, programmers use the flow diagram technique. First, the basic step-by-step

sequence of the program is modeled and checked; then it is optimized “in theory” in an abstract, easy-to-follow format.

Not until the last step does the programmer translate the flow diagrams into concrete commands. The commands of high-level languages facilitate extremely efficient translation of flow diagrams.

More flexibility as a standard

A major benefit of the Sinumerik high-level language is that it is a built-in feature of every Sinumerik. This means that any CNC programmer can use it directly in the CNC editor without additional software. Alongside solutions for special tasks, this language also offers key benefits when it comes to training: working with the Sinumerik high-level language increases the flexibility of CNC programs and gives trainees a fundamental understanding of how to handle higher-level programming languages. This enhances CNC training and increases aspiring specialists’ job opportunities. ■

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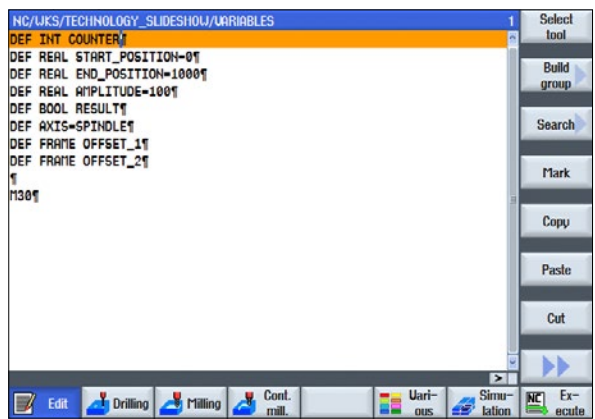
The Sinumerik high-level language

The Sinumerik high-level language includes all the fundamental properties of third-generation programming languages. Following are a few examples:

Abstract data types

The following types of variables can be defined in Sinumerik CNC programs:

INT	Whole number
REAL	Floating-point number
BOOL	Logical value
CHAR	ASCII character
STRING	Character string
AXIS	CNC axis name
FRAME	Coordinate displacement

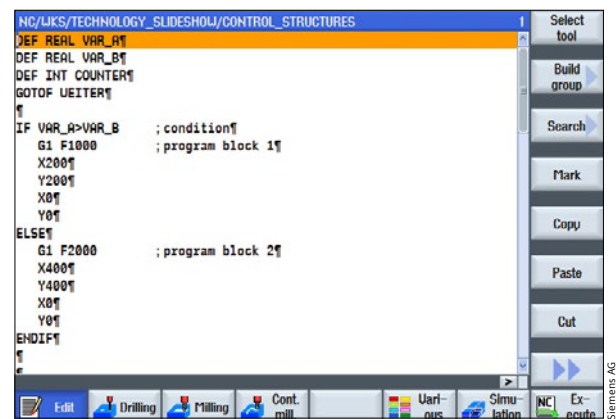


Abstract data types in the Sinumerik CNC editor

Control structures

The following control structures can be used in the Sinumerik CNC high-level language:

IF, ELSE, ENDIF	Conditional branch
LOOP, ENDOLOOP	Infinite programming loop
FOR, ENDFOR	For loop
WHILE, ENDWHILE	Program loop
REPEAT UNTIL	Program loop



Conditional branch in the Sinumerik CNC editor

Operations in the Sinumerik CNC high-level language

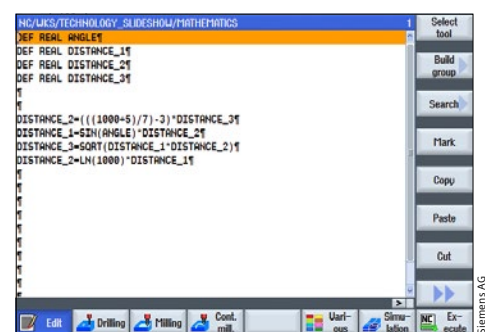
The following operations can be used in CNC programs (excerpt):

Comparative operation

== (equal to)
<> (not equal to)
> (greater than)
< (less than)
>= (greater than or equal to)
<= (less than or equal to)

Arithmetic operation

+, -, *, /
SIN(), COS(), TAN(), ASIN(), ACOS(), ATAN()
SQRT(), POT()
LN(), EXP()
TRUNC(), ROUND()



Arithmetic operations in the Sinumerik CNC editor



Perfect — and cost-effective — profile processing

Special processes such as broaching and slotting are usually used when manufacturing inner and outer profiles. However, slotting can also be carried out cost-effectively on CNC turning machines without special components.

On CNC turning machines, the workpiece generally turns, while fixed tools such as tool bits or drill bits remove the necessary material. However, when it comes to special turned parts with inner or outer profiles, such as gear hubs with keyways or splines, a fixed workpiece and moving tools are needed. Classic processes such as slotting and broaching are normally used for this. The disadvantage here is that the operator must change machines during machining, resulting in greater production costs.

Traditional machining of grooves

In mass production, optimized machines are used for each production process to ensure cost-effectiveness. There are four traditional processes: keyseating, slotting, broaching and EDM wire cutting.

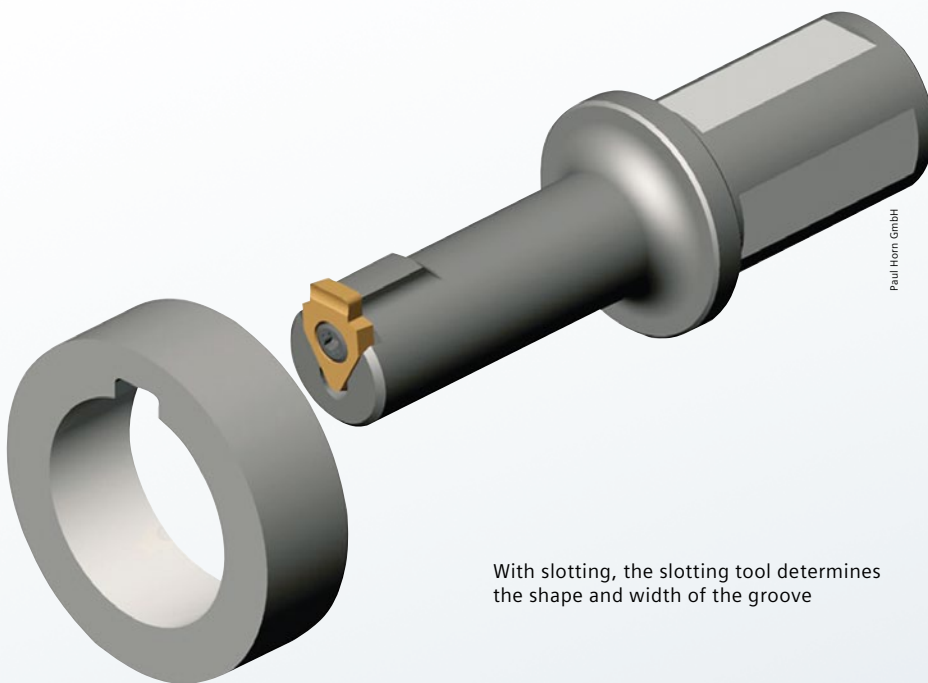
Keyseating is carried out using a draw-knife-like cutting tool, the shape and width of which determine the groove. Material removal takes place in several feeds; this process is suitable only for through holes. With slotting, the slotting tool determines the shape and width of the groove. Again, material removal takes place in several feeds; this process is also suitable for blind holes. The cutting tool used for broaching is a broach with several cutting edges sitting above one another. The material is removed down to the final dimensions in one stroke. Finally, EDM wire cutting forms shapes by means of electrical discharge machining. This process is suitable only for electrically conductive materials.

Slotting on the turning machine

A good alternative to traditional processes is to create the grooves or toothing directly on the CNC turning machine — particularly in the case of small series. It should be noted that special machine requirements must be met when slotting. Modern CNC turning machines are adapted to cope with these demands thanks to rapid axis movements and constant changes of direction, which are similar to those for tapping and to the high cutting forces of solid drilling.

The main cutting movement in slotting is in the z direction and is imple-

mented in the programmed feed by the fixed tool. The tool withdraws from the base of the groove at the end of the feed movement; the backward movement is an empty return stroke. The workpiece spindle is clamped tightly. The depth of the groove is set by means of the x-axis feed; the width of the groove correlates with the width of the slotting tool. In the case of groove widths that are greater than the tool width, the c-axis (main spindle) must be turned. In addition, if the groove base is to be even, a y-axis will be required for lateral displacement. The machine requires a programmable c-axis in



With slotting, the slotting tool determines the shape and width of the groove

Programming on the turning machine

Slotting is easy to program in the CNC control thanks to programGuide. R variables are defined, which are used in an IF loop in the NC program. The NC program might look like this:

order to be able to produce several grooves on the inner or outer diameter. The tool used is a slotting tool, which is defined in the tool management as, for example, a front-mounted parting tool.

If grooves are produced on the turning machine on a regular basis, the tool turret can be equipped with special slotting units. The rotary movement generated by the turret drive is translated into linear movement with a withdrawal function.

Creating perfect grooves

CNC specialists who wish to achieve optimum results when slotting should note several things: First, the groove should always be created in the top of the component so that the chips automatically fall downward from the cutting edge (due to gravity). Sufficient cooling is required during the slotting process for better material removal. In addition, plenty of scope for ejection must be ensured in through holes or undercuts in blind holes, to prevent breakage of tools or damage to turned parts.

Slotting can also be carried out on a milling machine or machining center. In this case, the tool is clamped in the fixed milling spindle. ■

```
; definition of R parameters
```

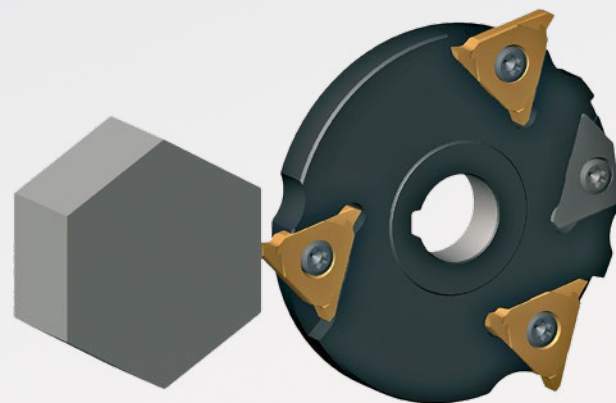
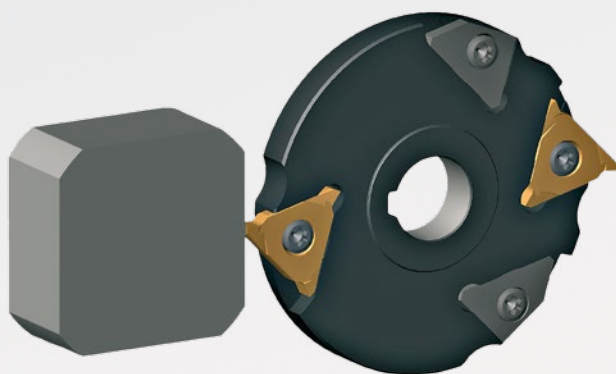
```
R1=30           ; diameter of hole
R2=1            ; depth of groove in X
R3=0.5          ; feed per stroke
R4=0            ; spindle position
R5=1            ; safety distance in X
R6=0            ; starting position in Z
R7=-51          ; depth of groove in Z
R10=0           ; number of runs already
                 completed
R11=0           ; runs required
R12=30          ; spindle increment angle
STOPRE
```

```
; calculation
```

```
R11=R2/R3
R8=R1-R5        ; diameter of hole + safety
                 distance
R9=R8
```

```
; NC programm
```

```
POSITION:
G0 SPOS=R4 G94 F5000    ; spindle starting position
M5
LOOP:
IF R11>R10
G0 X=R9 Z=R6+R5        ; starting position in X and Z
G1 Z=R7                ; stroke to feed depth
G0 X=R8                ; withdrawal
G0 Z=R6+R5             ; back to starting position
R9=R9+R3               ; offset of safety distance +
                       depth of groove
R10=R10+1              ; run counter
GOTOB LOOP
ENDIF
R4=R4+R12
R10=0
IF R4<360
GOTOB POSITION
ENDIF
M30
```



The cutting edge of productivity

Polygon turning is becoming more and more common in high-output series production of flats. One prerequisite for this is suitable turning machines and tools, as well as a CNC control system that supports synchronous spindle coupling.

Driven tools are being used on turning machines in more and more fields of application. The milling of flats, such as polygonal pins, has even become the state of the art. The only drawback to this process is the time that it takes, making efficient implementation difficult in mass production. For this reason, the use of innovative polygon turning in CNC turning centers is increasing. This is a continual process, similar to conventional turning, which allows users to halve machining time compared with milling. Time savings of up to 90% are possible with materials that are easy to machine.

Cutter in sync with the main spindle

In polygon turning, even surfaces — such as parallel flats or polygons (with three to eight sides) — are generated on the lateral surface of rotation-symmetrical workpieces using a cutter. The workpiece (the main spindle) and the rotating tool (the cutter) work in a synchronous coupling relationship, creating even surfaces. The number of surfaces generated depends on the translation relation and the number of cutting edges on the cutting tool. The workpiece and tool rotate in opposite directions. In practice, a translation relation of 2:1 is often used. This means that the cutter turns at double the speed of the workpiece. One cutting edge always works on two opposite surfaces. Accordingly, a tool with two cutting edges is used to turn a square, a tool with three cutting edges is used to turn a hexagon and so on. If the translation relation is different, or if a different number of cutting edges are used, surfaces may be very convex or concave.

The synchronous spindle function should be used in the Sinumerik to ensure coupled, synchronous operation of the main spindle and tool spindle. One spindle must be defined as the leading spindle and the second as the following spindle. The two spindles work synchronously in terms of position and speed. The coupling must be defined and activated in the program before machining and then deactivated and deleted after machining.

Radial and axial processes

Depending on the workpiece, the radial plunging procedure is used for flats, and the axial longitudinal turning procedure is used for polygons behind a flange. These are programmed using stock removal cycles combined with the contour editor, or in G-code. ■

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Programming example: synchronous spindle

```
COUPDEL (S2) ; possible couplings delete
```

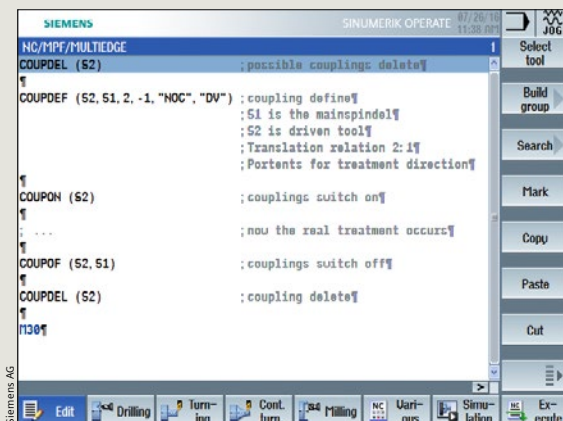
```
COUPDEF (S2,S1,2,-1,"NOC","DV") ; coupling define
; S1 is the main spindle
; S2 is the driven tool
; Translation relation 2:1
; Portents for treatment direction
```

```
COUPON (S2) ; couplings switch on
```

```
; ... ; now the real treatment occurs
```

```
COUPOF (S2,S1) ; couplings switch off
```

```
COUPDEL (S2) ; coupling delete
M30
```



Synchronous spindle coupling



Siemens AG



On the shopfloor

Mold making for racing

For nine years, KME Renntechnik has been supplying several different racing teams. With flexibility, quality and speed in CNC production for mold making, the company helps secure success on the racetrack.

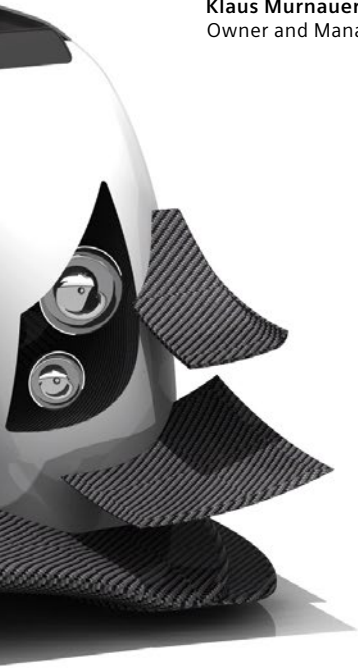
Motorsports have always been an important part of life for Klaus Murnauer, now the owner of KME Renntechnik. As a young boy, the qualified auto mechanic and mechanical engineer watched wide-eyed as fast cars sped around the track. During his studies, training and first few jobs, he learned about the design of motor vehicles and the various areas of mechanical engineering. Today, as owner of KME Renntechnik, Murnauer can draw on this experience when designing and producing molds and parts used in the chassis, engines, gears and other components of race cars. His thriving company currently has six employees and has made a good name for itself among many racing teams. Owner Murnauer says proudly: "Parts that we have produced

»These machining centers equipped with Sinumerik have the best price/performance ratio on the market for my needs.«

Klaus Murnauer,
Owner and Managing Director, KME Renntechnik



Klaus Murnauer has been won over by his two five-axis machining centers with Sinumerik 840D sl and Sinumerik Operate



KME Renntechnik has made a name for itself with molds, tools and finished parts for motorsports

are used in all DTM brands and can also be found in Formula 1. Just recently we received a big order from a well-known racing team that will be entering its vehicles into the next 24 Hours of Le Mans."

Molds, tools and finished parts offering the highest precision and reliability are KME's trademark. The company works with metals as well as plastics and carbon. This is one reason other sectors have also become aware of the company based in Rott am Inn, Germany. Racing dominates the company's business, at just under 70%, but firms from the medical technology and aerospace sectors (certification for airplane parts is already underway) are gaining in importance.

Short throughput times thanks to man and machine

What is this success based upon? The entrepreneur believes the answer lies in the company's extensive expertise, as well as flexibility and short throughput times. Customers have long considered compliance with accuracy and quality requirements to be a given. The manufacturing expert explains what he means by short throughput times by using the example of versions of a complicated laminating tool: "To start with, we work with the customer to define the size and form of the component, while we are at the same time acquiring the material. If it's a complicated component with free-form surfaces, we design and program it on our CAD/CAM system, save the program to Sinumerik 840D sl via the network and launch our Spinner U5-620 simultaneous five-axis machining center." At the end, all his employees have to do is draw- or mirror-polish the precisely machined laminating tool and install it as required. "Depending on the complexity, we only need three to five days for the entire process," adds the KME boss.

This is made possible by the fact that all his employees are well coordinated and work in 24-hour shift operation if necessary. KME also sees the machine tools, based on Siemens control system technology, as a key factor in the company's success. Murnauer singles

out the two Spinner U5-620 five-axis machining centers with Sinumerik 840D sl and the user interface Sinumerik Operate, which were acquired in 2012: "These machining centers equipped with Sinumerik have the best price/performance ratio on the market for my needs." With component complexity growing, 2+3 axes are extremely helpful, as it means that machining can usually be carried out in one clamping operation. The result is greater precision with shorter throughput times. "We are also getting more and more requests for parts with free-form surfaces. Thanks to the U5-620, that's no problem for us. This is because we can have the five axes of the milling machine running simultaneously," explains the manufacturing expert.

Five-axis machining and high-end control system for top quality

On the U5-620, a tool magazine with up to 55 spaces and a dual-arm tool changer minimizes idle time, and axis accelerations of 5 m/s² increase productivity. The digital position measuring system ensures high workpiece accuracy. The machines achieve positioning accuracies of Tp max. = 10 µm in the machining area and repeat accuracies of up to 3 µm in the individual axes.

Murnauer cannot make any general statements regarding surface roughness, emphasizing that it depends on



Various parts are manufactured using different materials and are used in the chassis, bodywork, engines and gears of race cars



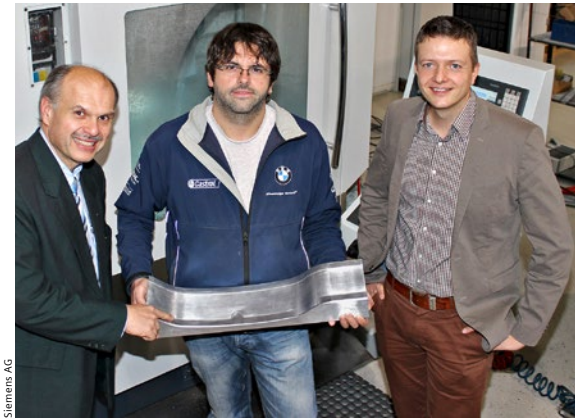
the different materials, feeds and feed rates. But he does provide one practical example: "When finishing high-strength aluminum, we often use a 10-mm ball cutter, which turns at $10,000 \text{ min}^{-1}$ and works at a depth and side feed of 0.5 mm, with a feed rate of around 12 m/min. The surface values of $R_a = 0.5 \text{ }\mu\text{m}$ to $0.8 \text{ }\mu\text{m}$ often requested by our customers cannot be achieved directly — however, postprocessing by hand, which takes only a few minutes, is enough to take us safely into the target range."

Alongside stable machine design, the top-quality control system and drive technology from Siemens is a great help here. KME uses the new version of the Sinumerik MDynamics milling technology package with the Advanced Surface intelligent motion control. The engineers have further optimized the Look Ahead function and integrated an efficient data compressor that aligns the modeled individual points so well during program generation that the machine can mill extremely smooth surfaces. The manufacturing expert also finds the intelligent jerk control helpful. It means that the axes are sped up and slowed down gently, despite extreme dynamic response.

Optimum operability for experts and "lateral entrant" employees

The head of KME is clearly also delighted with the ease of operation and programming facilitated by Sinumerik Operate. Cutting machine operator and CNC programmer Alexander Neumaier, for example, was skeptical when he first joined KME and saw that the company used only Siemens CNCs. He had been programming machines using another manufacturer's CNC for 10 years. And now? His reservations disappeared after two days: "I didn't believe I would be able to program and set things up more quickly with Sinumerik Operate than with my old control system after such a short time. I now create complete 3+2-axis programs directly on the machine."

The modern user interface is also advantageous for "lateral entrants" — employees coming in from different sectors — upon whom companies are becoming increasingly dependent due to the acute shortage of skilled workers. The reason? Contract manufacturing companies expect production workers to be able to program simple components directly on the machine tool. The ShopMill graphical work-step programming system helps



From left to right: Alois Penzkofer, user support and promoter at Siemens; Klaus Murnauer, owner of KME Renntechnik; and Maik Fritsche, sales employee at Böhm Werkzeugmaschinen GmbH, are delighted with the successful collaboration

here, because in this mode the CNC requests each individual command and models it visually. This means the operator is guided swiftly and accurately from the first to the last programming step. Plain text hints provide assistance in the event of uncertainty. Errors are extremely unlikely, as trained screed installer Georg Schartner confirms: "Although I come from an entirely different sector, I managed to program my first few small parts independently and fault-free after just one day." ■

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Happy birthday, IndustryArena!

The modern new building of the Industry Competence Center in Langenfeld, Germany, with more than 1,000 m² of office space

What started as a hobby for CNC user and consultant Frank Nolden is today the largest online skills network in the industry — IndustryArena.com. This year the industry community is celebrating its 15th birthday.

Just as young people can hardly imagine a world without smartphones, for many CNC practitioners, a world without IndustryArena.com is inconceivable. But it has not been around forever. Just 15 years ago, there was no way to rapidly communicate with colleagues from other companies about problems in CNC machining. Frank Nolden changed all that. In his free time, and on his own at first but then later along with other like-minded users, he launched today's leading industry forum under the name CNC Arena. In 2006, he took

the forum to an international level; then in 2009, he professionalized the support offered by creating a limited liability company with the involvement of the industry association VDW (German Machine Tool Builders' Association). In 2013, he established a partnership with the US forum CNCZone.com, which he then took over in 2016. In 2015, he acknowledged that the world of CNC production could no longer remain an island and that it had to start networking with other production processes. The result: CNC Arena has taken a further

step in its development and has become IndustryArena.com, addressing a wider range of topics. In 2016, the forum's anniversary year, Nolden's team, now with more than 20 full-time employees, is moving to a new, ultra-modern office in Langenfeld, Germany.

The CNC Arena and IndustryArena forums have changed the industry. They have brought users closer together but also closer to suppliers. What more is there to say? The Siemens Sinumerik team says congratulations and thank you!



Facebook for CNC professionals

An interview with Frank Nolden about the early years and the future of the forum



IndustryArena GmbH

»We need a skills network for the entire industrial production sector — and that's exactly what IndustryArena is intended to be.«

Frank Nolden,
Founder, IndustryArena.com

Mr. Nolden, how did you come up with the idea of starting an online forum for CNC users back in 2001?

Frank Nolden: Actually, it happened in the usual way: I was looking for a solution to an urgent problem in a production sequence. At the time, I was working as a CNC solutions consultant, and I saw all the problems practitioners were experiencing in companies. They were left to their own devices, as there was no communication between users at various manufacturing companies. And at the same time, the work, machines and processes were becoming increasingly complex. The only information source for users was the suppliers — and CNC users did not always get answers from them within a reasonable time frame or that fully answered their questions. That's when I came across the first travel forums, where travelers could share information on the Internet. That gave me the idea to start up a similar forum for CNC users — an information and dialogue platform for like-minded people.

How did you come up with the name CNC Arena?

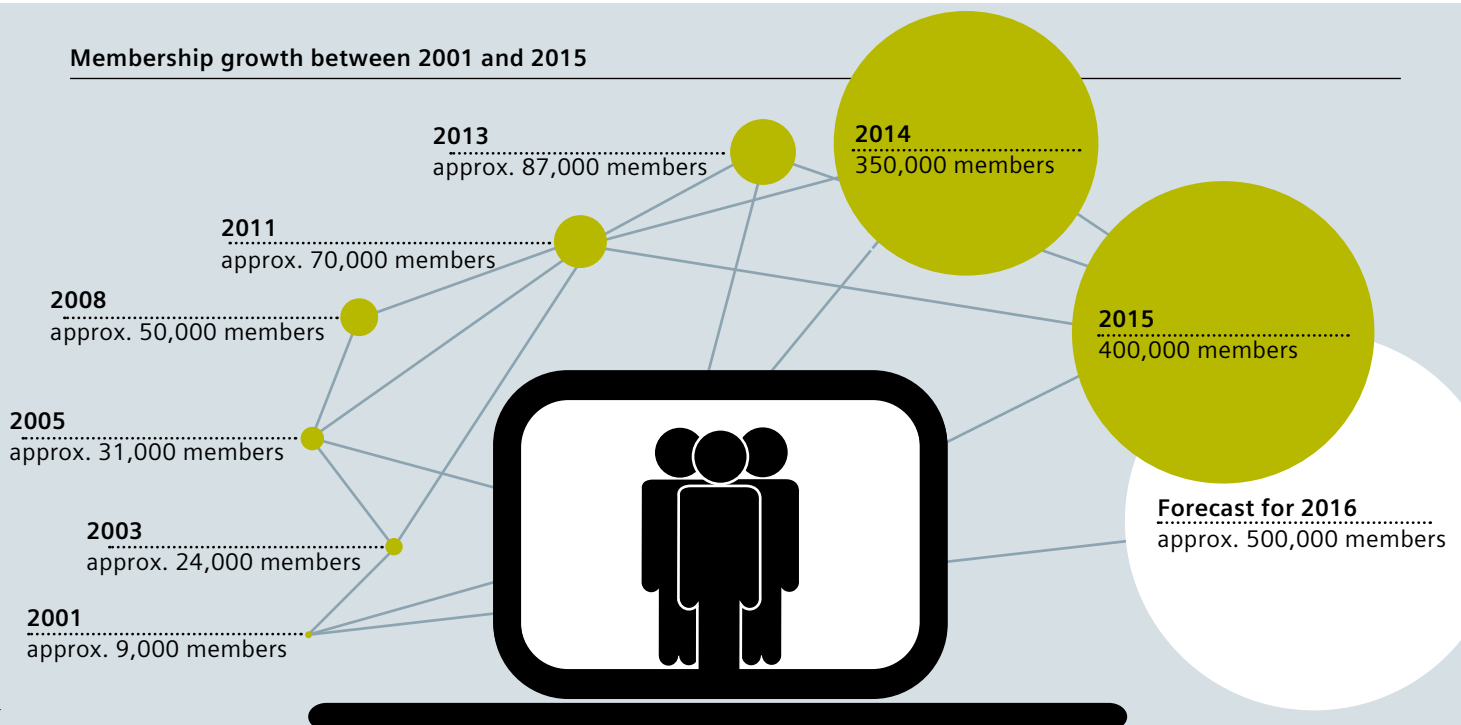
Frank Nolden: It was quite literally staring me in the face: the topic was CNC, and, living in Cologne, I saw the Cologne Arena on an almost daily basis. It wasn't a strategic consideration, more of a gut decision. But it worked well.

What were the biggest challenges when the forum started?

Frank Nolden: There was the fact that to begin with, I had to do everything on my own and alongside my job. During the day, I advertised to CNC users at the companies I visited as a consultant, using homemade information flyers. Then at night, I sat in front of the computer. I really did have to develop everything myself, and I also monitored the content of the forums. I then gradually found volunteers to support me with the monitoring, some of whom still work for us to this day. Of course there was resistance, and I couldn't always count on cooperation. Quite the

With more than 450,000 registered users worldwide to date, IndustryArena.com is one of the largest online skills networks in the world

Membership growth between 2001 and 2015



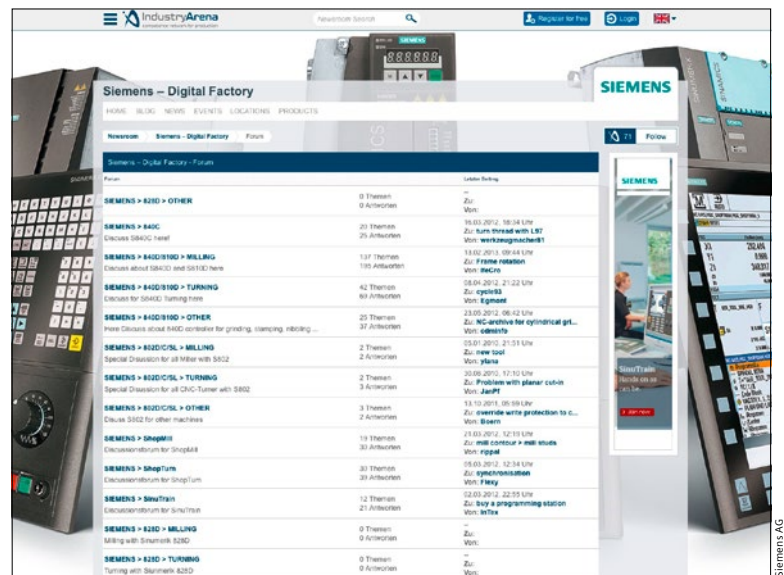
opposite, in fact: people who wanted discussions and an exchange of information with other companies were seen as “spies.” Neither the users nor the manufacturing companies, and especially not the suppliers, were prepared to openly share information back then.

How did you finance it?

Frank Nolden: To begin with, it was just an expensive hobby. And even for my first helpers in monitoring the forums, it was nothing more than that. We all sacrificed a lot of free time and money back then. But there was always one thing that remained important to us: the forum had to be free for CNC users. And that is how it has stayed to this day. Gradually, we got our first sponsors from the industry. Siemens was one of the first companies to support us as a sponsor. And it always remained clear: the companies were not to have any influence on the forums or access to addresses. Today, we have more than 3,000 companies as partners. These companies can provide information in various ways — for example, via our social media newsroom, webinars, job portals, information materials and so on. But we always keep a close eye on the user forums to make sure they remain free of influence, and we take strict action in the event of any abuse. Since 2009, the monitoring has been carried out professionally by a limited liability company with the involvement of the German Machine Tool Builders' Association. Since then, I've essentially turned my hobby into a job — what more could a person want?

In 2015, you renamed the platform IndustryArena.com. Not all CNC users and partners thought it was a good move. What were your reasons for doing this?

Frank Nolden: Even when CNC Arena was founded, what I wanted to do was give users the knowledge they needed to perform their day-to-day work. And I wanted to do it so quickly that it could actually be used in their day-to-day work. Our team wanted to pool the expertise of all users, so that they could master the increasingly complex work processes in the CNC-based production sector.



The free forum helps users with various questions relating to Sinumerik

Today, practitioners are facing new challenges: digitalization, networking, Industrie 4.0. By changing our name, we want to show that the world of CNC-based production is not an island. Machining technology remains the foundation, but we practitioners need to network, communicate with other areas of industrial production, and represent process chains that are both integrated and highly flexible. We need a skills network for the entire industrial production sector — and that's exactly what IndustryArena is intended to be.

On the occasion of the forum's anniversary, you opened your new office in April...

Frank Nolden: Yes, more than 1,000 m² of state-of-the-art office facilities. We have developed into a full-service agency for communication with users. Our ICC — Industry Competence Center — offers space for seminars, workshops and conferences. And, in addition to the virtual forum of IndustryArena.com, we also want to establish a real-world communication space here. We advise companies and help them communicate with users and customers in a more modern, effective and, most importantly, open way. We organize events, we produce videos, and we have a magazine and develop websites. Thanks to our long experience as operators of IndustryArena.com, we are able to offer users and manufacturers, as

well as suppliers, a great deal of added value here. We always focus on ensuring that users also benefit from improved communication with suppliers.

What are you most pleased about in terms of the development of the forum?

Frank Nolden: I think we have been able to really change the way we communicate in our industry, and our forum helps many users on a daily basis. All this is still free to users. And it allows for professional dialogue. Of course, there are occasional angry users in the forum who need to vent their frustration and stress. However, thanks to our extremely experienced moderators, we are able to resolve these issues in a targeted manner. We then communicate with the companies and bring specific users and suppliers into a personal dialogue — sometimes even away from the forum. And that's precisely why we always collect real names and telephone numbers when users register with us. The fact that no one except us uses these details is what sets us apart from many modern social platforms. I'm really proud of that, too. IndustryArena.com has proven extremely useful for users, which is precisely what I wanted when I set up the forum. ■

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Finding the best in class

Abu Dhabi, one of the most modern cities in the world, awaits the participants of WorldSkills 2017

At the 2017 WorldSkills competition in Abu Dhabi, more than 1,200 young professionals from 72 national teams will take part in 50 competitions, including CNC-based milling and turning. The national qualifiers are currently under way, providing an excellent opportunity for CNC4you to take a look behind the scenes at the competition.

Abu Dhabi, the capital city of the United Arab Emirates, is the venue for WorldSkills 2017, which will take place from October 14 to 19 next year. How important is the competition in terms of training, and why is the level of involvement of various companies and countries so different? We put these questions to Hubert Romer, managing director of WorldSkills Germany and president

of WorldSkills Europe, who understands the importance of the skills competition and the trends better than anyone.

How do young professionals get into these competitions, and how do they prepare for them? What is it like to personally participate in the WorldSkills mega-event? We spoke about this with Tizian Ulber, who represented Switzer-

land at WorldSkills 2015 in São Paulo, Brazil. Can companies also benefit from WorldSkills?

Elias Kalt, production manager at Swiss medical device manufacturer Hamilton Bonaduz AG, which has been sending trainees to the competitions for many years, explains why he is convinced that this is a worthwhile investment in the future. ■

A real benefit

Mr. Romer, looking at WorldSkills in the different countries, it's immediately clear that the competitions have very different levels of significance. Why is that?

Hubert Romer: Yes, the differences in attendance figures for the apprenticeship programs represented and the involvement of the various countries are very significant. A major reason is that the competitions are organized very differently at the national level. In Switzerland and many European countries, the competitions are affiliated with the chambers of industry and commerce and are financed by the private sector. In Asia, they are seen as a national competitive sport and are state run and financed.

...and in Germany?

Hubert Romer: In Germany, and in particular in German industry, the competitions have not yet gained the importance and status commensurate with our global economic significance. WorldSkills Germany is a registered association with around 70 members from trade and industry. Although companies such as Siemens are getting involved here, there is a lack of major support from businesses and the state. That sets us back somewhat by international standards.

How can the situation be improved?

Hubert Romer: We need to provide even better information and reach out to companies and young trainees more aggressively. The fact is that companies that have participated once immediately become firm believers and take part again and again. And I want these skills competitions to become a third pillar in apprenticeships, alongside the education and work aspects.

Why is that so important?

Hubert Romer: Learning for and during a competition is different. Our



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»WorldSkills is a career booster.«

Hubert Romer, Managing Director, WorldSkills Germany; President, WorldSkills Europe; and Delegate, WorldSkills International

studies show that participants develop an ability to work under pressure, leadership and decision-making abilities, and character, and they also create networks. All these are qualities that companies are urgently seeking these days. We use scientific research to follow the professional development of our participants, and we can see that WorldSkills is a career booster.

What advantages do you see for companies that send their trainees to the competitions?

Hubert Romer: There is a long list of advantages, not least of which is publicity for the profession and the significantly higher level of awareness of the company in the region. In Germany, companies are suffering from a skills shortage — awareness helps attract young people to the company, and a good reputation as a training company also generates new business. All these effects are clear.

Many small companies are afraid that they will lose good trainees if they become known through the competitions. How do you respond to these fears?

Hubert Romer: That does not reflect the experiences of the companies taking part: the competitions increase loyalty to the company. The young champions gain a great deal of additional experience in their preparation and in the competitions, which is a real benefit when they return to the company.

You have been involved in the professional championships for many years. Where do you get your energy and what drives you?

Hubert Romer: I see the competitions as a form of intercultural understanding on an international scale. One of my best memories was seeing Israelis and Palestinians working together so well in different skill areas at WorldSkills as well as in training. Personally, I find the idea of these competitions very compelling because I have seen the competitive mentality that the young people gain by taking part. The competitions bring out the best in the trainees — and there is so much more to them than many older people like to believe. ■





»I benefited immensely, both professionally and personally.«

Tizian Ulber, Mechanician Operator, Hamilton Bonaduz AG, and SwissSkills Champion 2014 and WorldSkills Participant 2015 in São Paulo

Meeting tight deadlines

The SwissSkills competitions are generally very important to Swiss companies. How are the national qualifiers organized?

Tizian Ulber: Almost 7,000 apprentices took part in 2015. That includes around 60 trainees in the CNC professions. The first round starts at the companies. All the participants are given practical tasks, and then the top 24 are invited to take a theory exam. The top eight performers in this exam then compete in the SwissSkills championships. This event in itself was great. All of Switzerland was watching. It was a fantastic experience!

...and in 2014 you were crowned Swiss champion.

Tizian Ulber: Yes, that was a great success. My instructors and I were absolutely delighted. And more than 40 SwissSkills champions from the various competitions qualified for WorldSkills. Together, we made up the Swiss national team for São Paulo.

What happened then?

Tizian Ulber: The national team learned about the competitions during a total of five preparatory weekends. We were also given mental training, so that we could work

toward solutions under extreme pressure. The training was so great that I even attended additional sessions.

And what sort of support did you get from your company?

Tizian Ulber: The support at Hamilton was excellent. Hamilton bought the same machine that we would work on in Brazil: a Romi 800 with Sinumerik 828D. Up until that point, Hamilton had never worked with Sinumerik before. Even before the machine was installed, I received support from Siemens: not only was I given Sinutrain licenses to practice with, but Hans Küng from Siemens Switzerland also gave me a huge amount of support throughout the whole period and answered any questions I had.

...and in Brazil?

Tizian Ulber: It was kind of like the Olympic Games. There was an opening ceremony where all the national teams paraded in front of more than 10,000 spectators. A really cool experience.

What happened during the actual competition then? You achieved a very good seventh place. What tasks did you face?

Tizian Ulber: The participants were given a 2D drawing that they had to transfer to a program, and then they had to produce the workpiece. There were more than 20 machines running in parallel, with a competitor working on each of them, all trying to produce the workpiece fault-free in six to seven hours. More than half the participants failed just because of the time constraints. And the workpiece itself was extremely complex — full of lots of difficulties.

What did you take away with you from these competitions?

Tizian Ulber: I benefited immensely, both professionally and personally. My training was already very good. But thanks to the competition, I was able to enjoy additional training sessions. In an apprenticeship you work in a protected environment, whereas the professional championships are very clearly a competition. This competition is probably worth 10 years of professional experience. And it goes without saying that traveling to Brazil as a national team with so many young people was incredibly cool. I wholeheartedly recommend it. ■

A worthwhile investment

Mr. Kalt, for how long has your company been sending trainees to the championships?

Elias Kalt: It was a management initiative in 2005 that prompted us to enter the competitions. That's why we have been taking part in SwissSkills regularly since 2006, with several trainees from various apprenticeships.

And Hamilton actually won a Swiss championship with Tizian. We've heard from him that you even invested in a new machine for WorldSkills?

Elias Kalt: Yes, that's right. As a SwissSkills champion, Tizian was eligible to participate in WorldSkills. We wanted to do our part to make sure he was well prepared to represent our company and country.

And are investments like that worthwhile?

Elias Kalt: Yes, we are convinced that they are. And the core issue here is not the championships but a good apprenticeship. Tizian was a great advertisement for us. Thanks to the additional courses at Siemens and other manufacturers (Fraisa, x-data, etc.), he learned a great deal about new technologies and processes in preparation for the competition. He also learned to work under extreme pressure. He and the participants from other age groups have brought back all this experience to our company. And we all benefit from that here. The competitions are an incredible experience for the trainees, but the companies are clear winners too. ■

The full versions of the interviews are available online at www.siemens.com/cnc4you

For more information about WorldSkills Germany, go to www.worldskillsgermany.com

You can find more information about the competitors at www.worldskills.org

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»We get a lot in return.«

Elias Kalt, Production Manager, Hamilton Bonaduz AG





Industry news



R&D Steuerungstechnik specializes in the retrofitting of heavy machine tools

R&D Steuerungstechnik GmbH & Co. KG

Retrofit in XXL

R&D Steuerungstechnik GmbH & Co. KG in Mönchengladbach, Germany, is marking an anniversary: this versatile company has been delivering retrofit projects for Sinumerik-controlled CNC machines for 20 years.

When Reiner Rohde founded R&D Steuerungstechnik with his business partner in 1974, he was still developing his own control systems, there was no talk of retrofitting for other manufacturers. It was only in 1996 that he said yes to Siemens — the start of a successful partnership. R&D now delivers 20 to 30 retrofit projects per year, and with more than 300 projects under its belt, the company has a reservoir of considerable experience. Customer motivations are varied — for example, customers from the automotive industry want retrofitting to maintain the stability of their processes. This allows OEMs and suppliers to save costs and time that would otherwise be spent on adapting and recertifying processes.

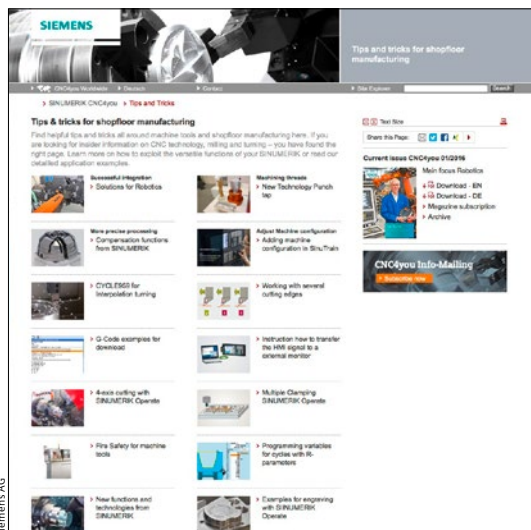
Considerable experience required

Other customers choose a retrofit because they wish to maintain the often excellent mechanical qualities of their existing machines. This was the case for a 20-meter-long Tacchi heavy-duty turning center for turbine production, which takes up practically the entire R&D factory hall. Sacha van Ool explains: "The mechanics and performance characteristics are already fantastic, but we are going to take the system to a whole new level in terms of electrics, control system and sensor technology." Heavy machine tools are a specialty of the retrofitters at R&D. Here it is not simply a question of modernizing the control system; this area demands experience in new construction or reproduction of mechanical parts and much more. For example, picking up and redelivering the objects to the customer, or commissioning at the customer's location, can involve extreme logistic challenges. Project terms of way over a year are not uncommon.

Individual concepts

The company's experience in retrofits has become more and more important in recent years; informal application and process knowledge is being lost because experienced operators are retiring from their companies. Detlev Gunia, managing director of R&D, describes the opportunities that retrofit projects provide in this instance: "We can produce operating concepts that are more closely related to the process and provide better instruction for new operators — about software-supported operator guidance and, in some instances, about the development of company-specific operator panels." Most of these projects use the Sinumerik 840D sl control system, which is easy to operate but is stretched to its limits when it comes to special processing, special tool implementation or requests for customized operating menus. By developing special cycles with appropriate operator guidance, R&D can implement most customer requirements of this kind. "I am happy that we chose Sinumerik back then. With more than 120 employees in various areas of the company, we handle retrofit projects both large and small and share this practical experience with developers from Siemens — an extremely valuable partnership for both parties," explains Gunia on the occasion of the 20th anniversary of the R&D-Siemens collaboration. ■

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Tips and tricks

Those looking for useful tips and tricks relating to machine tools and CNC machining with Sinumerik or insider information on CNC technology will find what they are looking for in the CNC4you portal. The contents of this edition have been newly added and include high-level languages, slotting and polygon turning.

All tips and tricks are available at a glance and can be accessed at any time at

sie.ag/2b04Vym

Production planning with Sinutrain

CNC users can prepare for machine work with the Sinutrain for Sinumerik Operate offline programming station, using just a standard PC or laptop. Customized packages are available for both production planning and training. The new Sinutrain versions replicate the software Version 4.7 SP3 and Version 4.5 SP6, which enables employees to work in a familiar environment. Sinutrain allows for realistic operation through the use of Sinumerik Operate and an animated machine operation panel.

With the new software versions, the user can gain a quick overview of the entire machine, as it is now mapped virtually on the Sinutrain interface ("workbench" framework interface). Sinutrain can also be adapted to match the real machine. This allows the real machine control system's configuration (e.g., axis configurations, cycles) to be mirrored in Sinutrain.

Download the free basic version at siemens.com/cnc4you.

[sie.ag/sinutrain](http://siemens.com/sinutrain)



Dates

BIMU	October 4—8, 2016	Milan, Italy
JIMTOF	November 17—22, 2016	Tokyo, Japan
IMTEX	January 26—February 1, 2017	Bangalore, India
Turning Days	February 14—17, 2017	Friedrichshafen, Germany

You can find an overview of additional trade fair dates and training courses in the Events section of the CNC4you portal.

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