



# motion world

The Magazine for CNC Automation

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**SIEMENS**

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Markets**



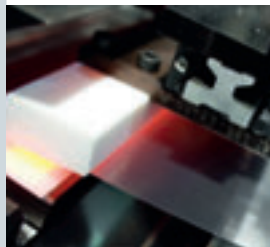
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Printed in Germany

**Uwe Häberer**

Head of Machine Tools  
Business  
Erlangen, Germany

**Dear reader,**

Japan represents one of the most important machine tool markets in the world. We from Siemens are certain that we can help you as machine tool manufacturers and users to increase your productivity and strengthen your position in this industry.

Success in export-driven markets are based on the acceptance of globally established open and flexible standards like Sinumerik CNCs from Siemens. Combined with a worldwide reliable service and support structure, this has been the crucial factor in many purchasing decisions around the globe.

As the market leader in factory automation, our solutions are based on the combination of trend setting and internationally renowned standards, which can be easily tailored to the individual requirements of each production. Whether hardware, software, IT-Solutions or CAD-CAM integration – everything you need for your success can be delivered from one single source, including consulting and engineering to the finished solution and service.

This not only includes the planning phase, but also active support right through to the machine's operating stage – with training and service as the cornerstones. Siemens automation solutions ensure maximum availability and productivity in production lines around the world. At this year's machine tool show, we focus on key industries like automotive and aerospace.

For large batch productions in the automotive industry, Transline Solutions for Powertrain from Siemens provides a worldwide well established standard, a benchmark within automotive. To a certain extent and on a global scale Sinumerik has become a standard in the Aerospace industry too. When it comes to mold-making or 5-axis machining, Sinumerik has always been and will be the benchmark and trendsetter. Above all that and for more than eight years Siemens has a very successful joint venture with Yaskawa (more on page 4).

Many reasons to deal a little bit more with Siemens – we are different!

Yours, Uwe Häberer

A handwritten signature in blue ink, appearing to read 'U. Häberer', written in a cursive style.



Jupiter

■ Yaskawa Siemens Numerical Controls Corp., Japan

# Reliable Partner in Technology

Japan-based support for Siemens CNC eases implementation of machine tool automation.

World-class customers like to buy from world-class suppliers. This is as true for builders and users of machine tools as for anyone else. Siemens' customers combine advanced technology with the highest quality standards. That's why they value the availability of outstanding support and backup, which gives them the ability to solve problems and continuously improve their products, wherever they are in the world.

Siemens is a global leader in factory automation systems with the reach to provide top quality service for all its customers. Siemens AG has 398,000 employees working in electronics and electrical engineering, generating total net sales world wide of over 83.9 billion Euros in fiscal 2007. The company operates in 190 countries throughout the world and in Asia Pacific, Siemens has 51 major facilities employing 66,000 people.

The industrial sector accounts for more than 50 percent of Siemens worldwide revenue covering factory automation and drives, industrial solutions, energy supplies, building technologies, lighting and transportation. The Drive Technologies Division provides complete manufacturing automation solutions

with their numerical control systems, converters, drive systems, gears and motors. Automation and Drives service for customers is provided by 295 service departments in 130 countries with the Siemens ASSIST program providing 24 hour 'follow the sun' cover.

## Japanese ventures

Yaskawa Siemens Numerical Controls Corporation (YSNC) was founded in October 2000 as a joint venture between Siemens AG (Germany), with its long-term experience in CNC, and Yaskawa Electric Corporation (YEC) from Japan, with its advanced drive and motor technology. The goal of the company is to provide Japanese machine-tool OEMs with CNC systems that are optimized for their applications, together with local expert support for commissioning and applications.

YSNC is a member of the big Siemens family and draws on technology and expertise from both Siemens and Yaskawa to provide strong local technical support for OEMs. At its head office in Saitama YSNC provides mainly sales and engineering. Three



additional regional sales offices located in Saitama, Hokuriku and Tyubu ensure that no Japanese customer is far from technical support.

YSNC offers a comprehensive portfolio of CNC solutions that stretch from unrivaled high-performance systems to cost-competitive, easy-to-use pre-configured systems for lathes and milling machines. These systems are used by Japanese customers in precision mold and die making and for mass production use in industries such as aerospace and automotive. In general jobshop applications the YSNC CNC solutions provide fast turnaround as well as high machine utilization and top quality output.

One of the core products is the Sinumerik 840DI, which provides a scalable digital system for complex machining tasks with finely controlled dynamics and high precision. Equipping their machine tools with Sinumerik CNC has enabled Japanese OEMs to enter new export markets, especially in Europe and in the automotive sector worldwide, with sales to Poland, the Czech Republic, India, Korea, and France. Almost all car builders in America, Europe but also in Asia such as Hyundai are among the users that bought the system.

### Committed to Japanese machine tool builders

The close partnership with Japanese machine tool builders and the ensuing high quality feedback from customers enabled YSNC to optimize its CNC systems and to launch the Yaskawa Siemens CNC series in Japan. The Yaskawa Siemens 840DI provides complete multi-axis and multi-channel control capability with open access to HMI, NCK and PLC functions, yet is based on a PC platform. The YSNC engineers in the application group at Saitama have worked with Japanese customers on a wide range of machining technologies using these systems including camshaft milling, grinding (surface, cylindrical, gear cutting), laser, water jet, balancing, turning and broaching.

### YSNC provides the full range of automation and drive services for machine tools



Siemens AG

In addition to the YSNC teams, Yaskawa Electric Corporation has its own technical support groups providing specialist support for its highly advanced drive and motor technologies. CNC service engineers of the Yaskawa Electronic Engineering Corporation (YEE) are ranged across Japan and Yaskawa Siemens Automation & Drives Corp. (YSAD) has a dedicated Sinumerik support team located in Tokyo Ariake.

### Support for the world market

Exports now account for more than 50 percent of sales by Japanese machine tool builders. The keys to success in export markets are excellence in technology, quality, functionality, and service. Functionality is a combination of machine performance and how the user can integrate the equipment into the production workflow and factory automation systems. Siemens is a world leader in product lifecycle management (PLM) and factory automation systems. Si-

» **We deliver and support**  
**world proven technology**  
**to Japanese customers.** «

Koji Orihashi, President & CEO Yaskawa Siemens NC



numerik CNC is the standard for many automotive and aerospace manufacturers around the world, and for them Sinumerik is the required CNC for any new machine installation.

When service is required, any YSNC system user has access to the worldwide Siemens network. Siemens provides the full range of services for automation and drive engineering in every phase, from planning to commissioning, to maintenance and modernization. Its specialists can provide the know-how to maximize the productivity and profitability of the customer's plant.

Using controls and drives from YSNC does much more than transform a stand-alone cutting machine into a sophisticated production unit capable of the most complex work. Together with the support of a global company, it also helps open new doors to worldwide markets in major industrial manufacturing groups. ■

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■ JIMTOF, Tokyo, Japan

# From Japan to the World

At JIMTOF 2008, the Yaskawa Siemens Numerical Controls Corporation and Siemens will be exhibiting their new products and solutions for machine tools equipment. Japanese machine manufacturers may find interesting new business opportunities at the booth.

The Japanese machine building industry is highly export-oriented and therefore relies on offering the technology that is in demand on the world market. In many growth markets, such as the automotive and aerospace industry, technological leader Siemens enjoys a high standing among customers as a global standard for control and drive equipment. Users and machine manufacturers are therefore well advised to take a closer look at booth 4011 Easthall with the Yaskawa Siemens logo.

For this reason, Yaskawa Siemens Numerical Controls and Siemens will be using this year's JIMTOF as an opportunity to introduce the Japanese trade visitors to its wide range of products, solutions, and services as an expert partner of international standing.

## Solutions for automotive and aerospace

Representatives of the automotive sector will be drawn to the "Solutions for Powertrain" exhibit. Siemens has created a Sinumerik-based equipment standard for powertrain, which many renowned manufacturers already consider an essential component of their new transfer lines.

Thanks to its 5-axis machining capabilities and open control architecture, the Sinumerik 840D platform has become a standard for the extremely demanding aerospace industry. Virtually all major manufacturers of passenger aircraft, as well as many first and second tier suppliers, are using Sinumerik



NC solutions to raise their productivity and competitive position in this lucrative yet challenging market. With its global presence, Sinumerik represents the quintessential, standardized automation platform for all technologies – be it milling, riveting, tape-laying, or jet cutting.

The booth will also be exhibiting software from Siemens PLM (Product Lifecycle Management) Software Inc., with a focus on Product Data Management (PDM), Computer-Aided Design (CAD), Computer-Aided Engineering (CAE), and Computer-Aided Manufacturing (CAM). Visit the booth to find out how PLM software optimizes the entire process chain: from design and production planning right through to manufacture itself.

### NC control for all performance classes

The booth will provide an overview of the wide range of Siemens and YSNC control solutions for NC-controlled machine tools and drives. These include the performance flagship Sinumerik 840D sl, the Yaskawa Siemens 840DI and 830DI, and the Sinumerik 802D sl. As Japanese machine manufacturers can certify, the YS 840DI/830DI have proved their worth as PC-based controllers used in conjunction with Yaskawa Sigma III drives with their 200 Volt technology.

The Sinumerik 840D sl with Sinamics S120 converters and Profinet communication is an ideal choice for the most demanding applications, such as mold

making or complex 5-axis machining in the aerospace industry. The system offers scalable performance, can control up to 31 axes, and, thanks to its open architecture, is the perfect solution for any job – be it milling, turning, grinding, or laser cutting. With the new TCUs (thin client units), the number of operating PCs can be minimized thus enabling the provision of cost-effective, customer-specific solutions, especially in the case of large distributed installations.

The system is also equipped with certified safety technology in the form of Safety Integrated, which is requested by many customers, in the automotive industry for instance, and does not require an additional bus. Machine manufacturers in the standard segment will be interested in the Sinumerik 802D sl with Sinamics S120 converters for 3-axis milling, turning, or grinding tasks. As a compact panel control unit with communication via Industrial Ethernet and Profibus, it offers impressive performance characteristics for this class.

### Added value for global business

Siemens is also very proud of “Sinumerik Manufacturing Excellence”, its new value-added service package for machine tools manufacturers and operators, which will also be presented at the booth.

As a leading technology provider, Siemens aims to offer value-enhancing services to machine tool manufacturers and operators all over the world. The Siemens experts have therefore developed services, such as Mechatronic Support, that enable machine manufacturers to strengthen their development resources and significantly reduce their time-to-market.

Condition-based maintenance is particularly interesting in terms of reducing machine downtime. ePS Network Services provide remote access, fault management and maintenance operations via the Internet, and Condition Monitoring. These services enable the continuous monitoring of machine tool conditions via automatic testing procedures. The approach involves analyzing trends, which makes it possible to detect any critical developments affecting a machine component at an early stage and take the appropriate action in advance.

Export-oriented machine manufacturers will also be very interested in the global service and support network and the rapid supply of spare parts that is guaranteed in virtually all world regions. The highly qualified local support experts also greatly contribute to the impressive international acceptance of Siemens equipment in machine tools.

Conclusion: A visit to the Siemens and Yaskawa Siemens booth at JIMTOF is worthwhile for both operators and machine manufacturers. ■

Yaskawa Siemens Numerical Controls Corporation and Siemens offer leading products and systems for machine tools on the world markets



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■ Matsuura Machinery Corporation, Japan

# Complex Machining Made Easy

Matsuura offers a 5-axis machining center that combines milling, turning and grinding functions.  
Yaskawa Siemens 840DI is the control of choice.



Carburetor machined  
with CUBLEX-25



**H**igh technology engineering industries need to produce complex components to a high level of accuracy. Ideally as many as possible of these operations should be completed automatically on one machine. But there are limitations to combined machines, because high accuracy 5-axis milling is difficult to achieve, complex or thin work pieces are difficult to clamp in a lathe type chuck and the size of the work piece is limited by the stroke length available. Lathe based machines work well for mass production of relatively simple work pieces but setting up for a new work piece production run can be difficult and time consuming. There was a clear need for improved 5-axis machining, better process integration and longer unmanned operation with complex machines.

### Matsuura takes up the challenge

The Japanese machine tool company Matsuura located in Fukui took up the challenge by developing a complex machine based on their experience in making 5-axis milling tools. Matsuura is one of the technology leaders in high performance machining, producing a wide range of machining centers including horizontals and verticals in all sizes, configured with 3 to 5 axis, single table, twin and multi pallet systems, twin spindles and tool changers.

Matsuura started development of their new machine tool, the CUBLEX-25 in 2004 and commenced production deliveries in 2007. The machine provides turning and grinding functions combined with 5-axis milling functions with no compromise in milling performance. With the extensive process integration capabilities of the CUBLEX-25, high-speed, high-accuracy machining is possible, together with extended unmanned operation. Developing the turning function was a challenge for Matsuura because the rotary table has to provide high static positional accuracy yet also spin at up to 3000 revolutions per minute. The table is driven by a high power direct drive motor fitted in the small space beneath it, but when the project started no such motor existed.

A technical breakthrough was the development of a compact synchronous direct drive motor, enabling Matsuura to proceed with further development of the CUBLEX-25. Working closely with its customers, Matsuura developed a unique mechanism to lock the work piece with the rotary table (C axis). This provides the high-speed rotation required for turning, while maintaining the precision positioning capability required for milling. Grinding operations are performed by the simultaneous rotation of the spindle and rotary table.

Compared with lathe based machines the CUBLEX-25 is relatively simple to set up, making it particularly advantageous for small to medium size production runs. By adding 10-pallet and 40-pallet changers the CUBLEX-25 provides completely automatic operation. Matsuura lineup brand-new CUBLEX-42, this is the same concept with CUBLEX-25 and able to machining larger size work pieces also exhibit at JIMTOF 2008.

### Sinumerik provides control

Key to the complex programming of milling and turning operations and the success of the CUBLEX-25 is Yaskawa Siemens 840DI software. The flexible software architecture has enabled Matsuura to achieve their goal of complete process integration and Matsuura only offers the CUBLEX-25 with Yaskawa Siemens 840DI CNC.

The Sinumerik system has provided Matsuura with a control platform for the development of a new class of machine. The CUBLEX-25 provides a combination of capabilities not seen before, top quality milling, turning and grinding functions supporting reliable unmanned production of high specification engineering components.

The hardware elements of Yaskawa Siemens 840DI Joint Solution consist of Sinumerik 840DI and the Yaskawa digital drive system include the Simatic programmable controller, all fully customizable. The PCU50 enables the Yaskawa Siemens 840DI to be used for a range of different applications from simple positioning tasks in two axes to 31 axes, of which 12 axes can interpolate in an NC channel.

The standard system offers a wide range of specialized functions for drilling, turning, milling, grinding and handling technologies.

### Top quality tool paths

For exacting applications such as 5-axis milling the continuity from the CAD system through to the workpiece and intelligent motion control allow fast, precise production of highly complex parts. For example on sharp changes of direction, the velocity is reduced beyond block boundaries thus preventing beveling of the contour. Additional NC functions include Spline interpolation and Look Ahead for really fast traversing. Jerk limitation ensures that motion sequences are smooth even at high speeds. Sophisticated control algorithms move the tool along the programmed path with highest precision. Compensation tables allow precisely to cope with distortion of the tool or other mechanical inaccuracies

The Sinumerik system includes a powerful geometry processor which allows the user to make corrections at any time and at any point in a finished program, dispensing with the need for separate programming workstations. For very small production batches the JobShop suite of programs uses a virtual machining block concept to bridge the gap between the drawing and the workpiece. These programs help the skilled machinist perform many workshop tasks more quickly to speed up the production of prototyping and small volume runs. ■

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■ **Trumpf GmbH + Co. KG, Germany**

## Successful Combination

**Trumpf punching and laser machines with Siemens drives and controls valued highly even in Japan**

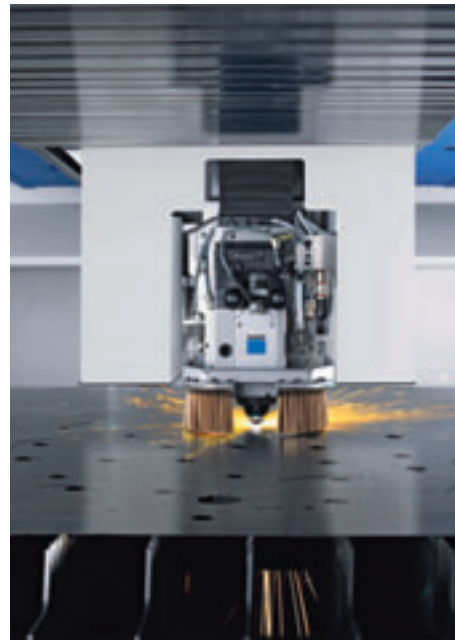
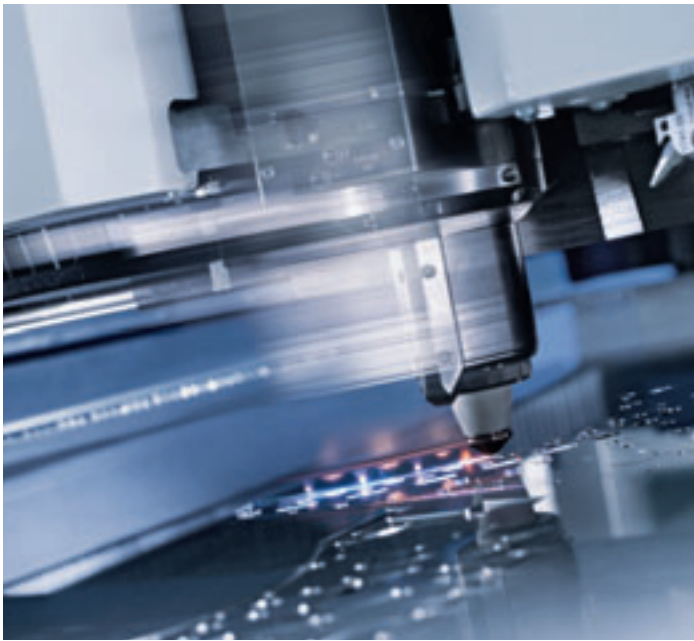
**T**rumpf, based in Ditzingen near Stuttgart, Germany, is the world's largest manufacturer of high-quality metal processing machines. Trumpf is at the forefront of its field, particularly with punching and laser cutting machines. Trumpf machines set a global benchmark for cutting speeds, accuracy, workable materials and workpiece geometry. The company's success has been largely shaped by its years of experience working with sheet metal and its specific machining processes.

### Open architecture for technology-specific functions

Behind the scenes of this outstanding achievement is Siemens drive and control technology. What Trumpf engineers above all value in Siemens systems most is the open architecture, because it allows them to fully map their own process expertise in the control systems and make it useful to the customer. This affects for instance the country-specific language in the

Human Machine Interface (HMI). Harald Dickertmann, Managing Director of Trumpf Japan, explains: "A key criterion for a successful market introduction in Japan was to ensure all dialogs for machine operators and programmers appeared in Kanji characters. This was no problem for the Siemens control technology."

Siemens above all offers open-architecture interfaces to link machine-specific NC technology with standardized drive and control technology. As Dickertmann explains, the integration of special technological features with the Sinumerik 840D can be carried out without any problems: "In the NC core, the standard system can be expanded to include our specific applications." This is performed using compile cycles. The interface used is OPI (OEM Programmer's Interface), which also establishes the connection to the system data. The machine builder's software modules are mounted at defined points in the NC core software system. The standard system data ensures full compatibility with all future software versions, safeguarding any future develop-



With the punch head of the Trumpf TruMatic 6000 workpieces can be processed to a variety of different geometric requirements with few punching tools

ments by Trumpf to expand the NC core. The Sinumerik/Simodrive open-architecture control and drive system therefore offers maximum freedom to implement customer-specific applications and technology-specific functions.

The CNC Sinumerik also fulfills all prerequisites for precisely tailoring the HMI to these functions. Configuration and implementation are supported by the OPC open communication interface and the Siemens programming and configuration package. ProTool/Pro provides all the elements needed to create an attractive and clearly laid-out user interface, such as picture elements, Windows fonts, and operation via the mouse or function keys. User and programmer interfaces are quick and easy to generate using the large selection of standard input and output fields, bars, diagrams and graphics.

### Reliability matters

Trumpf uses the whole package, including CNC Sinumerik 840D, Simodrive drive controls and 1PH asynchronous servo motors, for example in the TruMatic 6000 combined punching and laser cutting machine. As Dickertmann points out, Siemens control and drive components are renowned even in Japan for providing the best in reliability and quality. "Reliability is a crucial criterion for users in Japan. Downtime due to drive and control components failing is completely unacceptable over there."

The TruMatic 6000 combined punching and laser machine processes (without readjusting) sheets measuring up to 2,585 x 1,650 millimeters at punching forces of up to 220 kilonewtons. The punch head can rotate through 360° at up to 900 or 2,200 revolutions per minute, making it possible for workpieces to be processed to a variety of different geometric requirements with few punching tools. Even strips, threads

and other three-dimensional forming operations are possible. The machine is easy to set up, thanks to the cartridge tools in a linear magazine and the automatic assignment of tool sets to processing tasks. The laser can cut sheets up to 8 millimeters thick. The punching and laser machine's high level of automation enables optimum productivity. Completed parts are either discharged from the processing area into a container via a chute or securely stacked on pallets with the Trumpf SheetMaster automation solution. The punching and laser machine can also automatically unload and shred scrap skeletons.

### Open for wide range of peripherals

An open architecture also plays a vital role when connecting peripherals. Japanese customers prefer to use Japanese brands for their forming machine systems. "In Japan, we need to connect our punching and laser machines to a variety of different transport devices and automated storage solutions for sheet metal. The open architecture of Siemens control systems makes this possible, which has helped us get a foot in the door of the Japanese market. Naturally, Trumpf has a comprehensive range of its own peripheral devices for fully automating sheet metal processing," says Dickertmann.

The concept has already proven itself in the market, which is why the TruMatic combined punching and laser machines are not the only systems to be gaining in popularity; more and more Japanese users are also turning to the TruPunch punching machines and TruLaser flat-bed laser machines. ■

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Picture: Siemens AG

■ Toyo Advanced Technologies Ltd., Japan

## Highest Accuracy with Highest Quantities

Toyo grinding machines ensure the necessary precision of Hyundai's gearbox production in Nosovice/Czech Republic.

The Japanese machine manufacturer Toyo has been producing grinding machines for the automotive industry for almost 80 years, and is now the first port of call in Japan when accurate internal grinding is required. These machines are predominantly used in the automotive industry and by suppliers of drive components, but are also used in the production of bearing shells, compressors, and air conditioning systems. The company has supplied 18 fully automated machines to Hyundai's gearbox production site in the Czech Republic. Fitted with loading mechanisms, the machines are integrated in the fully automatic production line and assist in the manufacture of cogwheels for the plant's annual output of 300,000 gearboxes. The machine type T-11L59, for example, is equipped with a small auto-loader and can grind a cylindrical hole with a diameter of 40 millimeters in a cycle of less than 22 seconds. The roundness deviation is less than 1.4 micrometers, while the surface roughness is a mere 0.4 microme-

ters. The T-11JAG machine type is designed specifically for mass production. With a gantry loader fitted as standard, this machine can grind the inner and plane surfaces of the cogwheels in just 40 seconds, fully automatically and without losing any accuracy.

### More productive with Sinumerik

The entire Hyundai production line is structured according to the Transline concept. This Siemens-developed standard carries a number of important advantages for the system operators. For example, the use of a component list reduces the number of automation components employed, thereby also minimizing the necessary spare parts stocks. Standardized interfaces greatly facilitate data communication with the control level, while uniform operating screens lend all control panels a consistent look and feel. Since Hyundai wishes to utilize these benefits, Siemens was named as the preferred supplier of

control technology. However, this was not the only reason why Toyo equipped its grinding machines with Sinumerik 840D for the first time. There were also other good arguments to support a move towards CNC: The in-house motion control-based system had reached the limits of its capabilities. As a highly flexible system, Sinumerik 840D was the obvious choice, since it would allow the company to react to customer requirements in a flexible manner, and implement new functionalities.

### Challenges overcome with optimum support

Two challenges had to be mastered in the switch to the new system: The Toyo engineers had no experience with Sinumerik controls and Hyundai had set a very tight timeframe, allowing only eight months from order receipt to the delivery of the two different machine types in the Czech Republic.

Initially, the programmers had some difficulties in grasping the unusual style of programming within PLC, but according to Mr. Norito Sako, Manager of the Engineering Planning Section at Toyo, it soon proved to be very practical and enabled both clear and flexible programming. The Toyo technicians also mastered the NC programming very quickly. In the course of their work, some functions turned out to be particularly useful. For example, the execution of synchronized functions in different channels of the numeric control allowed them to reduce cycle times and increase air cut accuracy. During the commissioning of the machine, Siemens supported Toyo with its on-site service. This allowed any questions or issues to be resolved quickly, thereby avoiding any delay in the tight schedule. "A YSNC technician dedicated a lot of support to us and we greatly appreciate this," states Mr. Akihito Fukumasa, Staff Manager of the Electrical Engineering Section at Toyo. Following the first preliminary meetings in the fall of 2006, the order was placed in January 2007, and 18 machines of two different types were on their way to the Czech Republic as early as August 2007.

### Great performance across the board

Initial tests conducted during commissioning showed the high quality of the drives: Even with the default settings of the Simodrive 611D drives, the precision of the machining met the requirements of the machine. Further improvements were achieved by fine-tuning the parameters, ensuring that the machine operates within the tolerance range even with shortest of cycle times. Hyundai is thrilled with its new grinding ma-

chines. "On the basis of our first production tests during commissioning, we are expecting excellent results," says Yeong-Don Yoo, Head of Hyundai's Maintenance Department in the Czech Republic. A Toyo technician is still working on-site in an effort to optimize the grinding material; the aim is to



The CNC internal grinding machine is designed for mass production and equipped with a gantry loader as standard

achieve shorter cycle times with the same levels of precision by improving metal removal. In this area, the Sinumerik 840D still has plenty capacity in reserve.

When production begins in 2008 and Hyundai is manufacturing 300,000 gearboxes a year, Siemens will be responsible for servicing the machines in the Czech Republic and supplying spare parts for their controls and drives.

Thanks to the rapid implementation of this project and the results achieved, Toyo are in no doubt that the Sinumerik 840D was the right choice and one that represents an important step in their future development. With increasing globalization, it is becoming more and more important not just to build high-quality machines, but also to have a reliable partner with a global service presence. ■

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■ **Komatsu Machinery Corporation, Japan**

# Komatsu Goes Into Higher Gear

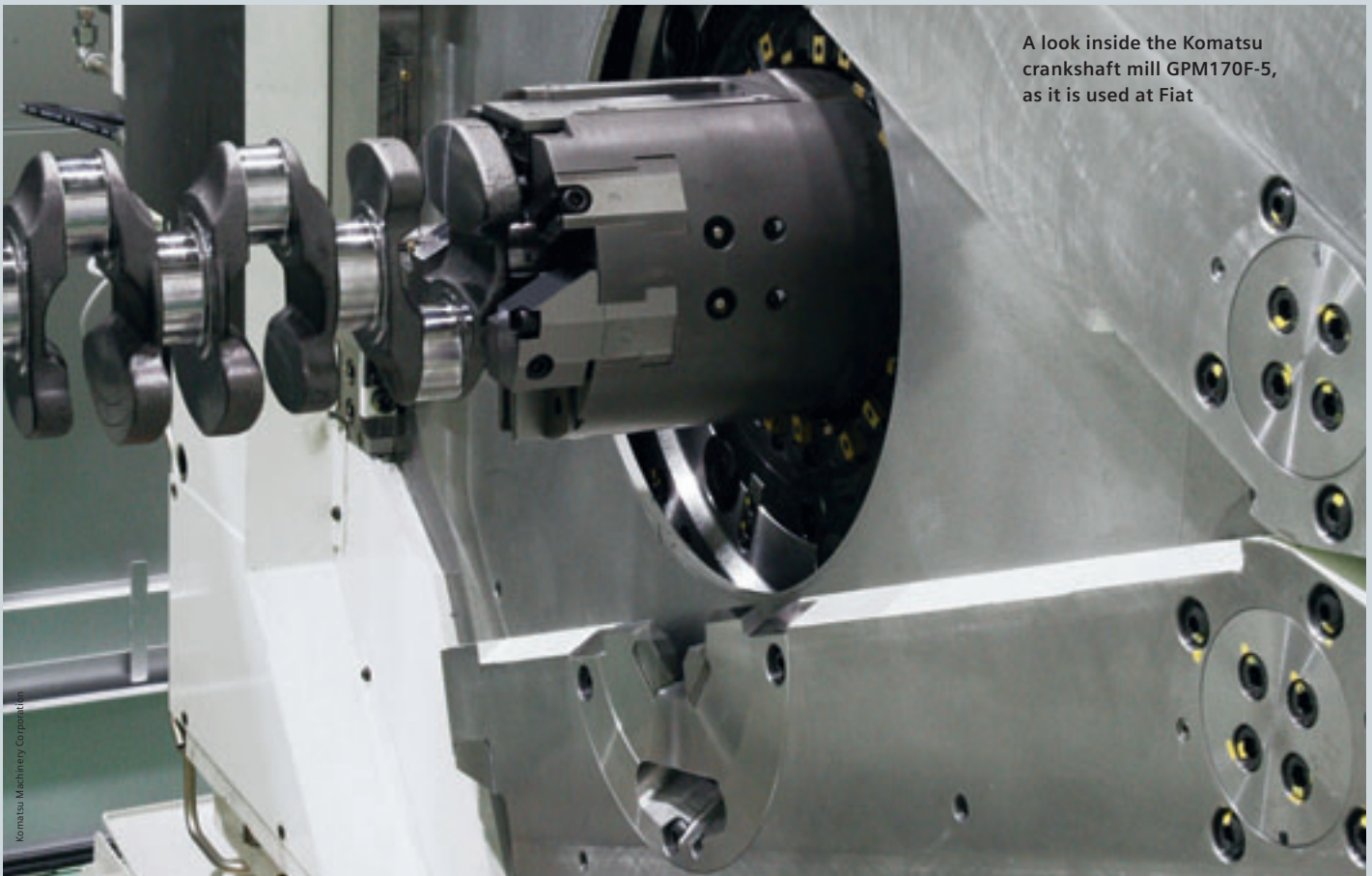
Machine tool supplier cranks up worldwide opportunities using Siemens CNC.

**K**omatsu Machinery Corporation is one of the top suppliers of crankshaft milling machines with almost 100 percent market share in Japan and Korea. In 2001 Komatsu began an expansion into new world markets with an order from Fiat of Italy, employing Siemens Sinumerik control systems. This, together with the worldwide support of Siemens helped Komatsu to win new customers and complete

new installations around the world e.g. Poland and India.

Komatsu produces many machines for the manufacture of internal combustion engines including camshaft millers, roller burnishing machines and turn-turn broaching machines. A new milling-centering machine has been developed and top of the range is a complex machining center capable of five-

A look inside the Komatsu crankshaft mill GPM170F-5, as it is used at Fiat





face complex machining and slanted complex machining in one chucking. Komatsu also manufactures high precision machines for semiconductor manufacturing equipment and production of flat screen displays (LCDs).

### Five-fold sales

For the production of crankshafts the principal machine supplied by Komatsu is the crankshaft mill. Komatsu has developed three generations of this machine. Early machines were of the external type with the cutters located externally and the workpiece rotating. In the second generation the cutters were located internally with rotating workpiece, enabling cutter stiffness to be increased by a factor of 2.5. The latest development of the crankshaft mill features an internal cutter with fixed workpiece. This machine is more compact because of the internal cutter and the workpiece can be tightly clamped, reducing vibration during cutting.

Production quality is improved and the lifetime of the cutting tool is extended, reducing costs. Crankshaft mills are now supplied to automobile and engine manufacturers all over the world. These developments have helped Komatsu Machinery to increase sales from 4 billion yen in 2001 to 20 billion yen in 2007.

In 2001 Komatsu won a contract from Fiat to supply two sets of internal crankshaft mills for its engine plant in Poland, a total of four machines. Fiat specified Sinumerik 840D and Simodrive 611D drives for the crankshaft mills. Sinumerik 840D is a complete digital motion control system for complex machine tools. The system includes the programmable controllers, servo-drives, motors networks and software. The Sinumerik system is scalable and can be applied from a single lathe to a complete factory automation system. Although the system offers a wide range of specialized functions for drilling, turning, milling, grinding and handling, the same basic control modules are used across many machining technologies and conveyor, placement and handling systems. This enabled Fiat to integrate the Komatsu crankshaft mills with other systems in its Poland engine plant.

### Fiat relationship develops

A feature of Sinumerik is its very open and accessible architecture. This enables the machine tool manufacturer to customize and tailor the operation of the machine and the human interfaces, incorporating its own specialized know-how and operating philosophies.

The Fiat contract was the first experience of Komatsu in working with Sinumerik systems. To assist Komatsu in customizing the programs and human interfaces for their crankshaft mill, Siemens engineers worked at the Komatsu facility in Japan for an initial period of three months. They worked on training, application engineering, commissioning and programming. When it came to the installation of

the crankshaft mills at the engine plant in Poland, Komatsu needed some component assembly work to be done locally. Fiat engineers introduced Komatsu to a nearby contractor who was able to help them complete the installation and bring the machines up to full performance. This was the start of an enduring relationship of Komatsu with Fiat.

### Supplying machines to India

The Poland engine plant project was followed up in 2006 with an order from Fiat for five machines to be installed at Fiat Tata in India. For this project two different types of machine were supplied, an external mill and a turn-turn broaching machine. At the



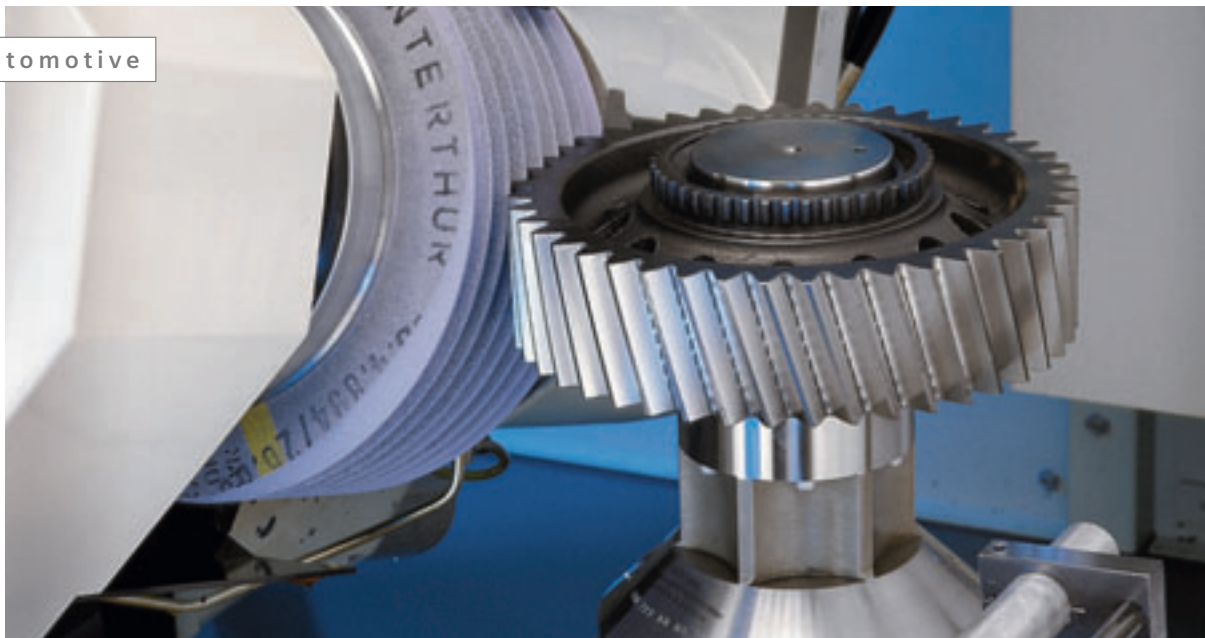
Fiat Tata builds the Palio in its Pune factory with Komatsu machines

outset of the project Komatsu approached Yaskawa Siemens NC (YSNC) – a joint venture of Siemens with the leading Japanese motor drives manufacturer, Yaskawa – to supply the drives and Sinumerik controls. For the configuring of the Sinumerik controls on the new machines YSNC provided an expert engineer who worked at the Komatsu plant to provide application engineering support. He worked on PLC design and debugging, human interface (HMI) engineering, commissioning and training.

With the experience that Komatsu have built up in working with Sinumerik systems, the company now has three fully trained engineers able to support customers worldwide. The successful Fiat Tata project has now been followed up with a further order. Komatsu is to supply a camshaft mill customized with Sinumerik controls. With the standardization of Sinumerik across different machines and the ongoing support from YSNC, Komatsu will also approach this project with confidence. ■

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■ Reishauer AG, Switzerland

## Geared for Success

Cooperation between Siemens and Reishauer  
paves the way for European control technology  
in the land of the rising sun

From time immemorial, Japanese companies have favored local technology, particularly in the field of control and drive technology. However, a few European manufacturers are now managing to break into the market with their own machines – among them Reishauer AG, the leading manufacturer of high-quality gear grinding machines and diamond tools. Following more than 200 years of corporate development, from a small craftsman's workshop through to an industrial manufacturer of machine tools; Reishauer's gearing technology is today primarily found in the automotive industry, but the company also addresses other branches of industry. The development of modern control and drive technology has been a major factor in the company success, allowing it to utilize previously unimagined methods of optimizing gearing geometries. As a result, gear grinding machines are today equipped with distributed motion control systems with up to twelve axes (some of which are inter-

polating) and are CNC controlled. This allows precise grinding of optimized gear geometries and gear profiles according to requirements and within a tolerance of just a few micrometers. Of particular note are the surfaces, where specifications in the micro-range are required to meet the need for low-noise gears through improved tooth shifting. The sheer possibilities offered by modern control and drive technology alone allow practical solutions and concepts to be developed.

### Technological leaders through cooperation

Working in close cooperation with Siemens specialists, Reishauer developers in Wallisellen near Zurich (Switzerland) have been able to implement key improvements time and again. The open structure of the control technology is one of the main advantages for the developers and programmers as it allows them to map and store their own process-specific expertise in

Japanese technicians are extensively trained at Reishauer's head office in Switzerland.



the control system. For this purpose, Reishauer also utilizes the possibility to augment NC core functionality with compile cycles. Siemens technology also excels in Human Machine Interface (HMI) programming, providing almost unlimited configuration options: for example, a process can be mapped graphically via the operation terminal, where the user can access the process via interactive fields and the keyboard. Detailed displays for monitoring the process and troubleshooting in the event of a fault can be configured as required.

Reishauer has produced a series of gear grinding machines that are recognized around the world as leaders in the field thanks to their high-quality mechanics. For example: It is possible to optimally process gear wheels from module 0.8 to 10 millimeters, with a weight of just a few grams up to 600 kilograms, and having a diameter from 6 to 1,000 millimeters. Dedicated automation systems with loading and unloading units and storage for raw parts and finished gear wheels enable these machines to operate continuously and with minimal human operation requirements. In addition to the grinding and part spindles, the working area also contains high-precision dressing devices with up to 6 NC axes for close-to-process truing of worm grinding wheels of the highest quality.

### Sinumerik and Simodrive as a complete drive package

Reishauer relies on a coordinated system platform: the Sinumerik 840D and the Simodrive drive system. This ensures precise and high-dynamic feed and in-feed motions through all axes – key factors contributing to high surface quality and exact geometries. These criteria are fundamental to low-noise, smooth gears. The high power densities of the drive motors give the gear grinding machines a compact footprint. In addition, the excellent dynamics and high performance of the drives mean that users obtain maximum benefit from modern gear tools and ensure

that Reishauer gear grinding machines achieve the productivity needed for cost-effective series grinding.

### Recognized as the technology leader in Japan

Klaus Peiffer, Head of Technology at Reishauer, sums up the situation as follows: “Consistent use of technical opportunities and the excellent cooperation between Siemens and Reishauer specialists have made a major contribution to the global success of our gear grinding machines.” Not even the car manufacturers in Japan can deny that anymore. They want their cars to become the best in the world, and have already achieved this goal in some vehicle classes. This means they also need the best technology in their component production – and they know no better gear grinding machines than those from Reishauer. The proven combination of high-quality mechanics and future-oriented control and drive technology from Siemens guarantees the highest quality in gear grinding, and represents the first key step in successfully opening up the previously closed Japanese market to European control and drive technology.

### Service quality as a major plus

Reishauer operates its own service and consultation office in Japan to ensure the high productivity of its gear grinding machines. The office is staffed by several engineers and technicians – mostly Japanese and extensively trained at Reishauer's head office in Switzerland – ready to support customers immediately when needed. This approach of using local resources trained in Switzerland provides the ideal combination of technical expertise and understanding for the regional mindset and national customs. ■

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■ Forest-Liné, France

# Tape-Laying for Japan

Tape-laying machines from Forest-Liné, equipped with Sinumerik 840D are producing solid productivity results for two Japanese aircraft suppliers.

Carbon fiber reinforced plastics (CFRP) is the material of the future when it comes to building aircraft. This is because it is much lighter than a metal alloy yet stronger and more solid, making it easy to understand why the latest generation of passenger aircraft now contains many parts made from this lightweight material.

Even the new Boeing 787 passenger aircraft, the “Dreamliner”, contains more than 50 percent CFRP parts. These are supplied by the first-tier suppliers and then assembled to form a plane at Boeing.

Core parts of the fuselage and the wings of the new Boeing jet are among the components that are made from carbon fiber. These are produced by two renowned Japanese first-tier suppliers.

To produce these parts, the Japanese companies require special laying machines for the resin-impregnated carbon fiber; these are known as tape-laying machines. These machines are supplied by the French manufacturer Forest-Liné based in Capdenac; the company was specially selected as the exclusive partner for CFRP laying machines following extensive evaluation.

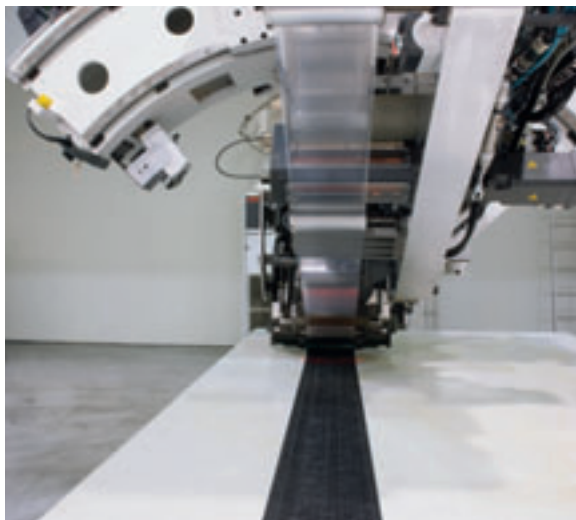
## Precision reigns supreme

In order for CFRP to be used efficiently, it is paramount that optimum process reliability be achieved in conjunction with the fastest possible laying speed. Tape laying involves placing the carbon fiber bands – “prepregs” – onto a workpiece carrier in hundreds of layers alternating between angles of 0°, 90°, +45° and



-45°. This is where utmost precision must prevail in order to ensure that there is neither a gap nor any overlap between each individual web. The finished part is then placed into a special oven – an autoclave – for heat treatment in a vacuum, so that a high-quality composite part is produced from the individual layers of carbon fiber.

Meticulous laying at the highest speed is required if this expensive procedure is to achieve results. It gets tricky when prepreg webs cut to complex dimensions must be laid. “Conventional systems cut these parts directly in the laying machine, meaning that the laying process has to be stopped for a short period, and this has a negative impact on the laying efficiency,” explains Philippe Tavernière, CEO at Forest-Liné in Capdenac.



The Atlas tape-laying machine lays resin-impregnated carbon fiber tapes in Forest-Liné's test center

Cutting out of preregs with the Access machine shown and laying them in a separate step is the secret of the high productivity delivered by Forest-Liné's machines



Pictures: W. Geyer

## Sinumerik in the 'Land of the Rising Sun'

Forest-Liné delivered five Atlas tape-laying machines almost 40 meters long and three Access cutting machines to produce the almost 40-meter long wings for the Dreamliner. The French company also supplied one Atlas machine and one Access machine to produce the central wing box.

All laying machines from Forest-Liné are equipped with Sinumerik 840D NC control, Simodrive 611 servo-drive and Simodrive 1FN3 linear motors for feed rates of up to 60 meters/minute along the X, Y and Z axes.

The open NC kernel is the selling point of the Sinumerik for Forest-Liné. "Parameters can be changed easily, thereby further optimizing the machining process by making the laying time more efficient, which results in increased productivity," explains Patrick Rousseau, project manager at Forest-Liné.

During this process, the French inventors from Capdenac enjoy pushing themselves to the limit and exhausting the technological functions of the Sinumerik 840D; they work closely with Siemens in Toulouse during this time. New machining cycles developed by Siemens are regularly presented by Siemens to the development team in Capdenac, and more than once Forest-Liné has suggested a new function to Siemens and then seen it included in its machines.

## Support package for getting started

To support the users in Japan in the best way possible with any questions they may have regarding control and drive, Siemens and Forest-Liné decided to have a service engineer from Siemens Japan trained in tape-laying technology by staff for a week on an Access-Atlas test machine at Forest-Liné premises.

Further confidence-building measures are being taken by the Siemens branch in Japan to ease the challenging Japanese aerospace clientele into the world of Sinumerik. Siemens Service and Support has established a rapport with the maintenance staff of the clients in Japan, so as to guarantee speedy delivery of spare parts (e.g. for motors or sensors) from the manufacturer in the event of service requirements.

However, no major incidents have been reported so far. The machines at the Japanese first-tier supplier's plants produce reliable structural components and wings with a 98 percent availability rate. The fifth tape-laying machine with cutting machine is currently being installed. Forest-Liné is flying high in Japan, and a large part of the praise goes to the prize performer Sinumerik. ■

## Two-phase success model

Forest-Liné is taking a new direction with its two-phase system. It allocates the tasks of cutting prepreg parts with complex dimensions and direct uncut laying to two different machines. Access, the special cutting machine, cuts the tapes, which are then transferred – on a carrier film and a protective film spooled on a cassette – to the actual tape-laying machine, called Atlas. This contains two laying heads in one machine. The first one performs simple cuts with the in-built ultra-sonic cutting device. For complex shapes, the second head continuously lays the pre-cut tapes from the Access machine that have been unspooled from the cassette, ensuring that the laying process is continual.

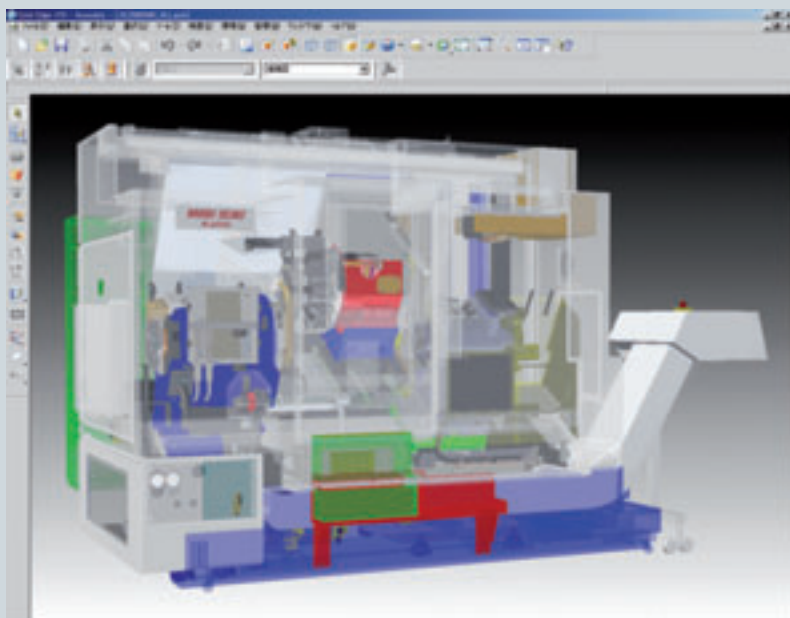
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■ Mori Seiki, Japan

# A Solid Foundation

Solid Edge from Siemens PLM Software is the support behind Mori Seiki's product design advancements.



Designed with Solid Edge from Siemens PLM Software, the NL 2000 is one of Mori-Seiki's best selling machining centers

## Grasping designs more easily

The first benefit of the introduction of Solid Edge was that Mori Seiki's design review process was rejuvenated. "When we were using 2-D drawings in our design review process, often only the designers could understand the designs," says Fujimoto. But now that the company has made the switch to Solid Edge, even the nondesigners are able to easily grasp the design concepts and thereby more easily contribute their ideas to the design process.

3-D modeling has made it easier to perform various types of analysis that play a critical role in improving design quality. Mori Seiki uses an array of analysis tools to perform vibration, structure, and thermal and operational performance analysis. Fujimoto says that this makes it possible to anticipate product performance during the design stage. Thanks to 3-D modeling, Mori Seiki has been able to improve the basic performance of its products and, with its highly successful N Series, reduce manufacturing time by 20 to 30 percent when compared to that of conventional products at equivalent prices. This has contributed to a sharp reduction in the overall lead time from development to manufacturing.

## Product development time halved

Makoto Fujishima, director and general manager of Mori Seiki notes that "it used to take us about six months from development to prototype, but now we are able to complete the prototype in about three months." Fujishima points out that the transition to Solid Edge enabled Mori Seiki to double the pace of new product development.

Data are currently shared using a file server, but Mori Seiki is reviewing the possibility of transitioning to Siemens' data management system, Teamcenter software, for this role in the future. ■

**M**ori Seiki currently owns 280 Solid Edge licenses, making the company what one might call a "heavy user" of Solid Edge. "The purpose for introducing 3-D design tools was to reduce our design-to-manufacturing lead time and vastly improve our quality of design," explains Kiyoshi Fujimoto, information systems manager at Mori Seiki. In addition, Mori Seiki anticipated that the Parasolid software kernel would be the future standard for solid modeling, so the company made the decision to use Solid Edge throughout its enterprise.

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This article is based on Siemens PLM Software case study in 2005



■ Siemens Erlangen, Germany

# Effective Simulation

**Sinumerik Virtual Machine allows for seamless integration of PLM-CAX for machine tool programming**

In the past, simulation of NC machining was based on standard CAM system simulation software, which usually emulates the controller. A CAM system simulates the 3D machine tool, the tooling model, and the kinematics. In this way, a basic machine simulation is used to roughly optimize the NC code.

Today, with the Siemens Virtual Machine a new dimension of controller-driven machine tool simulation is possible. This is due to the integration of the Sinumerik 840D software kernel plus a 3D simulation of the machine and manufacturing process. All tools, fixtures, and parts are available within this simulation, as well as all cycle and time calculations.

The Siemens CAM-CNC technology brings together the virtual world of the engineering environment, where the manufacturing plan is defined, and the physical world of the shop floor, where the manufacturing plan to produce the parts is executed. In the virtual world various activities are conducted such as fixture designs, CAM programming, process planning, resource management, and generation of work instructions. Whereas the physical world is about CNC machine execution, NC programs, tool and parts.

The machine-tool simulation is effectively a digital simulation of the real machine. It can be calibrated using the virtual NC kernel with all the parameters and settings from the controller of the real machine.

Many customers are already using this virtual machine in the NC programming office as well as on the machine shop floor. The technology is in full productive use today.



With the Virtual Machine NC programs can be verified and optimized with full confidence in a controller-driven simulation environment

## Optimizing the whole process chain

Siemens is also working on further developments relating to the CAD-CAM-CNC connection, to optimize the process chain. These include technologies such as CAX features and spline representations for the seamless integration.

Further, production and engineering data management such as CAM data and resource management, tool inventory management supports a uniform approach. Connecting the virtual with the physical world can be done with Siemens tools. Those form a common data backbone, optimize the processes, and maximize machine tool utilization. ■

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## ■ Mechatronic Support

# Significant Benefits

The example from Gildemeister shows: Siemens Mechatronic Support service shortens time-to-market and reduces costs in the development of modern machining centers.

The Deckel Maho Seebach GmbH (DMG) belongs to the Gildemeister Group and develops, builds, and markets high-quality vertical machining centers. In these centers, the company uses direct drives that help to achieve higher productivity.

For the design of machines with direct drive technology, the rigidity of the machine modules, such as bed, in interaction with measuring systems, drives,

and closed-loop control determines the overall controllability. Because of that, DMG has made use of the Siemens service Mechatronic Support during the development of the DMC 75 V linear. Siemens Mechatronic Support is delivered by highly-qualified and experienced engineers from Siemens Headquarter in Erlangen, Germany. Uwe Gampe, at that time DMG Design Manager, summarizes: "We would have produced a good result without the Siemens support too, but certainly not in such a short time and possibly not with this perfection."

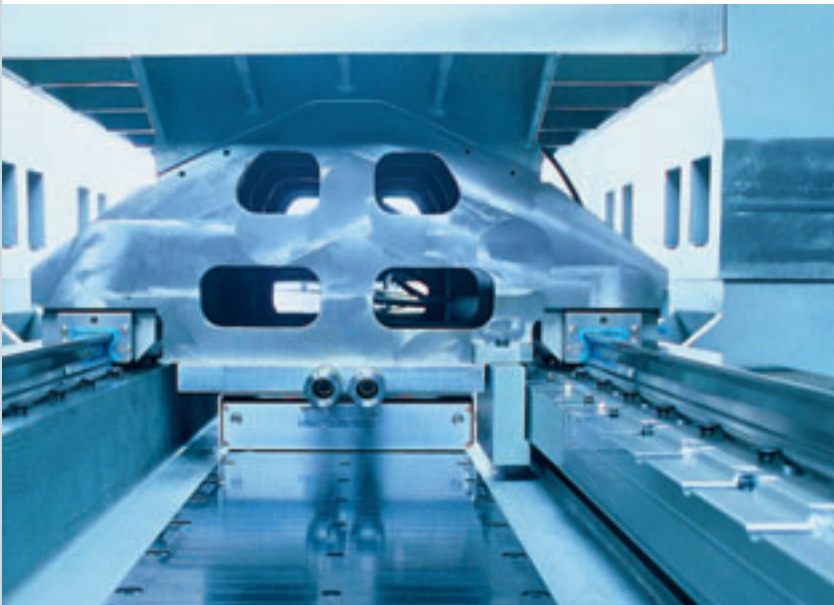
**» We would have also produced a good result without the Siemens support, but certainly not in such a short time and possibly not with this perfection. «**

Uwe Gampe, at that time DMG Design Manager

## Mechatronic Support: what this means

Based on a finite element (FE) model of the machine tool mechanical design, the Siemens mechatronic experts perform calculations that take into account the interaction of mechanical design, measurement systems, electrical drives as well as numerical control and closed-loop control. This kind of simulation is used to analyze and improve the main performance parameters that are expected with the new machine. The construction of a physical prototype and real measurements to confirm the performance data is not necessary at this stage of the development.

In particular for machine tools with direct drive systems, it is necessary to modify the previous conventional machine design, since the reaction forces are fed directly in the machine structure. The Mechatronic Support often is used to easily compare different machine concepts. Company DMG directly used the suggestions from the Siemens mechatronic calculations and simulations in the subsequent design of the DMC 75 V linear and was able to produce a result that reaps the full benefits of direct drive technology. ■



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■ Yaskawa Siemens Automation & Drives, Japan

# Sitrain in Japan

YSAD offers Sitrain courses in Japanese language specifically tailored to the Japanese customer's needs

One of the most important factors for quality, reliability and safety of industrial processes and manufacturing is a good and highly skilled workforce. In order to cope best with such industrial demand, Siemens has established a global product training program called Sitrain, which is available in more than 60 countries to provide comprehensive training skills for its Industrial Automation and Drive Technology products to their customers. Already in 2002, Yaskawa Siemens Automation & Drives Corp. (YSAD) – a Joint Venture of Yaskawa Electric Corp., Japan and Siemens AG, Germany – started their customer trainings related to Siemens Automation & Drive products. With the establishment of a dedicated training center in Tokyo in 2005 the training capability has been developed further ever since. YSAD offers Sitrain courses in Japanese language specifically tailored to the needs of Japanese customers. The courses cover almost the complete range of Siemens Automation & Drive products, e.g. the Simatic and Sinumerik product family and the Sinamics and Simotion drive technology range for all single, multi-axis servo and general application drives.

## Dedicated YSAD Tokyo Training Center

The YSAD Tokyo Training Center offers training facilities specifically equipped for the courses provided. Facility No. 1 covers motion control and drives, e.g.

Simotion and Sinamics, next is used for machine tool training, e.g. Sinumerik and Simodrive, and the final one is dedicated for automation systems, e.g. Simatic and Profinet. Courses are presented by highly skilled trainers who have been trained at Siemens Sitrain Headquarters for Industrial Automation and Drive Technology in Germany. Regular participation in sitrain train-the-trainer programs keep them up-to-date with the latest technical developments of products and training know-how.

The Training Center delivers several courses a week with course details and schedules available from YSAD's web site. However courses may also be presented at customer's premises. Supporting web-based training is also available to supplement courses being held at the YSAD Training Center in Tokyo. As training may also be provided in English language, of course training documentation is available in both Japanese and/or English. The training program covers all aspects of industrial automation, from basic introduction to system configuration, commissioning and operation up to maintenance, if required. Also various levels of experience and capability can be provided ensuring that operators are able to maintain optimized product quality and maximum system utilization. ■

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