Machining centers carry within their CNC DNA the ability to communicate digitally, machine-to-man or machine-to-machine. Machining centers no longer function as isolated stand-alone islands of production and, increasingly, are productive stations within cells. These production assets produce data that can be tracked, collected, and analyzed in real time based on scenarios that were simulated and verified in virtual space and time. With advances in controls, manufacturers are able to improve production flexibility and efficiency with their traditional machining processes and accommodate the latest developments in advanced manufacturing technology.

Dave Karlstadt is a steer farmer with hooves on the ground in Bryan, OH, who made a decision a few years ago to add manufacturing to his business portfolio. He recently purchased a new Genos M560-V vertical machining center from Okuma America (Charlotte, NC) for cutting large parts for the oil and steel industries. Karlstadt Machining now has a total of 19
Okuma machines and, in six years, Karlstadt’s machining business has doubled in size and he has moved into a new 12,000 ft² (1114 m²) facility.

“With the Genos functionality we’re able to run parts in less time and compete with the rest of the world,” said Karlstadt. The Mid-Auto function on the control is a feature he can’t live without. “In the middle of the program, at any point in time, you can completely stop the machine and then hit restart, and it goes right back to where it came from. That’s a pretty nice feature. The reliability of Okuma machines has played a huge role in our success, and our direction for the next five years will be to add a couple more Genos machine tools, plus a horizontal machining center with a pallet changer. Being able to produce quality parts on time is our biggest advantage,” said Karlstadt. The Genos M560-V features a 30 hp (22.38-kW) spindle with 150 ft-lb (203.37 N·m) of torque for cutting challenging metals such as titanium and Inconel as well as stainless steel and aluminum.

DMG Mori and Schaeffler Technologies (INA and FAG bearings) have collaborated to develop a prototype machine as a means of elevating service and maintenance processes to the forefront on the road to future-oriented production, process, and maintenance optimization. The intelligent machine at the center of the project, called Machine Tool 4.0, is a DMC 80 FD duoBlock turn/mill that has more than 60 sensors installed on its basic components. The first prototype was introduced at EMO-Milan 2015. A second prototype is up and running in everyday series production at the Schaeffler Hochstadt (Germany) plant.

The developers believe that calculable availability of means of production (uptime) ranks as a decisive factor in the realization of cyber-physical production networks. All data on machine operation and performance over time are captured in real time and analyzed using specially developed algorithms with an eye toward optimizing uptime.

DMG Mori and Schaeffler have developed a test platform based on a DMC 80 FD duoBlock turn/mill that is monitored in all its basic components with more than 60 sensors. Introduced at EMO-Milan, the Machine Tool 4.0 platform captures data on machine operation and performance in real time, over time, for analytics using specially developed algorithms with an eye toward maximizing uptime.
unplanned machine downtimes quickly render capacity planning a waste of time.

Energy and running costs have also been reduced significantly in addition to the increase in availability and simultaneous reduction of service costs. This new “knowledge” also constitutes the basis for the sustainable optimization of processes, products and machines. Both machines have an identical integral Industry 4.0 concept, from the sensor to the cloud that connects existing technology with the new possibilities of digitalization and data analysis and thus masters the close interplay of mechanics, electronics and information technology.

Operating status and process data that are collected continuously in real time and saved are processed both locally on the machine in Celos, DMG Mori’s common user interface with multitouch screen for its high-end machines—as well as in the cloud. DMG Mori has developed a special Celos App—the Condition Analyzer—that functions as the information center on the ERGOline control with Celos and via which all status information is visualized and from where the operator can immediately initiate any actions that might be necessary. In addition, the collected data are analyzed in the cloud using specially developed algorithms in order to detect potential faults or problems in the process by means of qualified forecasts. This status information is then fed back to the machine. Structuring by means of Apps makes Celos as easy to operate as a smart phone. As a result, users benefit from a 30% saving in setup time and 50% less effort for calculating technical values and searching for important information.

On The Way To Industry 4.0—Digitization in Machine Tools

Siemens Industry Inc. (Elk Grove Village, IL) and Siemens PLM (Plano, TX) offer an integrate portfolio of industrial software and automation technology to enable companies to improve their production flexibility and efficiency and, at the same time, reduce their time to market. Siemens Digital Enterprise Software Suite comprises...

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software products for every facet of the value chain for discrete-part manufacturing industries.

Included within the product lifecycle management (PLM) software are NX and Tecnomatix. NX software is an integrated solution for computer-aided design, manufacturing, and engineering analysis (CAD/CAM/CAE). Tecnomatix is a suite of software for designing, planning, and simulating the digital factory. In addition, Manufacturing Executive System (MES) Simatic IT, the Sinumerik CNC controllers, and the Simatic S7 controller portfolio are designed to optimize production applications.

Uptime ranks as a decisive factor in the realization of cyber-physical production networks.

Siemens, in cooperation with KUKA Roboter GmbH, has developed the intelligent Run MyRobot interface for integrated automation of machine tools and robots. Both machine tool and robot can be programmed, operated, and monitored using the CNC control alone. The execution of the machine tool and robot program can be tracked and controlled on screen on parallel channels, providing the operator with a quick overview of the current status of the machine tool and the robot. Siemens envisions a future for robots far beyond their familiar tasks of lifting, positioning, and welding as today’s robots are being fitted with milling, grinding, and other heads so they can be used to deburr, grind, cut, trim, polish, finish, and glue, among other processes.

For shops of all sizes, Siemens Smart Operation application is designed for efficient control of work processes utilizing the Sinumerik 840D sl CNC. Smart Operation allows all kinds of work at the machine tool to be performed with great flexibility and speed, boosting productivity. The new concept includes job preparation, IT networking, improved usability with touch

Continued on P56
SmartBox Digital Integration Delivers Manufacturing Access to IIoT

Mazak, Cisco, and MEMEX have collaborated on developing a launch platform technology that provides easy and highly secure access into the Industrial Internet of Things (IIoT). Introduced at Mazak’s Discover 2015 Technology event, SmartBox technology provides access to real-time manufacturing data to improve overall productivity and responsiveness to customer/market changes. Using the MTConnect standard as its foundation, SmartBox connectivity of machines and devices provides enhanced monitoring and analytical capabilities including advanced cyber security protection. At Discover 2015, SmartBox was demonstrated in one of the automated cells as part of the company’s own manufacturing operations with each of the cell’s four machines equipped with a SmartBox and an array of sensors.

The SmartBox is another component within Mazak’s continuing development of its iSMART Factory that takes advantage of Cisco’s Connected Machines solution to provide insights into machine operations. Advanced manufacturing cells and systems, along with full digital integration, can achieve free-flow data sharing, i.e., process control and operation/equipment monitoring. The iSMART concept also incorporates Mazak’s Smooth Technology, which is a complete process-performance technology platform that includes the various levels of Mazak’s new Mazatrol Smooth CNC.

SmartBox is able to work with any machine regardless of make, model or age. The device physically mounts to the side of machines without having to integrate into a machine’s electrical cabinet. With several standard input/output connecting ports, SmartBox lets users quickly and easily connect any standard off-the-shelf sensors to the system for machine data gathering and condition monitoring. One SmartBox can service several machine tools along with other associated manufacturing equipment, depending on the application.

The Memex software installed in Mazak’s factory allows for monitoring analytics of machines, test stands, and other equipment within the plant. The Cisco hardware is designed to help prevent any issues with unauthorized access from both directions—to or from the machines and equipment within a network. SmartBox satisfies the highly critical security concerns of IT departments when connecting legacy equipment to a plant’s main network for the purpose of gathering manufacturing data via the MTConnect protocol.

The underlying Cisco networking platform helps ensure that IT technicians will be familiar with SmartBox’s operation and can use it to quickly and easily control and manage network security. Also, the hardware allows manufacturers to enable secure machine communications through secure access and identity policy mechanisms. Third parties, such as equipment suppliers, can then log on to a company’s network and access only those machines equipped with a Mazak SmartBox.
Siemens enables robots to be easily connected to machine tools for automated production cell setup using Sinumerik 828D and 840D sl CNCs. Different types of robots designed by various manufacturers can be connected to machines for handling tasks using Sinumerik 828D and 840D sl using the Sinumerik Integrate Run MyRobot / EasyConnect interface.

Software Creates Self-Contained Manufacturing Cell

For customers requiring exceptional repeatability and accuracy with automation, the Yasda H40i-PC24 five-axis high-precision machining center from Methods Machine Tools Inc. (Sudbury, MA) is well-suited for manufacturing a low volume, high mix of complex parts. With 400-mm square pallets, the Yasda H40i-PC24 is well-positioned to meet the demands for the tighter tolerances and shorter cycle times required by manufacturers in segments such as aerospace, die/mold, and automotive. Complete with Methods Advanced Pallet Scheduler (MAPS) and Methods Advanced Tool Software (MATM), the H40i-PC24 is a self-contained manufacturing cell.

MAPS is an easy-to-use touch screen-based system allowing users to assign a sequence of operations (CNC programs) to a pallet and automate the delivery of pallets and CNC programs to support multifaced fixture machining. User defined, priority-based schedules provide a rich set of functions and features that give the user a flexible system for attended and untended operations.

The MATM System is an application that is engineered to manage tools and their associated data. The system is integrated into a tool cart located at the machine’s ATC, providing a convenient workstation for tool setup, loading and unloading operations. Balluff RFID Read/Write is available as an option to MATM.

The Yasda H40i-PC24 is equipped with direct drive (DD) motors in the rotary axis for simultaneous high-speed five-axis machining with B and C-axis rotational speeds of 100 and 75 rpm, respectively. A high-performance 40-taper screen operation, and the use of mobile devices to perform monitoring and control functions. Smart Operation simplifies the integration of machines into the production process and doesn’t require support by IT specialists and can be implemented independently by machine operators.

Multitasking machining technologies like turning, milling, and drilling, as well as workpiece and tool measuring, are being combined on one machine tool with the latest version of Sinumerik Operate 4.7 user interface and the Sinumerik 840D sl CNC. Siemens sees great possibilities for solutions for Additive Manufacturing within its portfolio of CAD software for the aviation, machine tool, and automotive engineering markets.
spindle provides optimal power and torque for machining a wide range of metal alloys, while minimizing thermal distortion for optimal tool performance and high surface finishes.

The Yasda H40i-PC24 has a large work envelope—travels are 34" (864 mm) on the X axis, 29" (737 mm) on the Y axis and 27" (686 mm) on the Z axis. For its large work capacity, the Yasda H40i has a compact footprint of less than 27’ (8.23 m) in length and under 11’ (3.35-m) wide, fully configured with 24 pallets, which is an economical use of valuable floor space. Methods also offers the H40i-24PLS, which is a 24-pallet version with a part preload station, B&C-axis DD motors, and 240-tool capacity.

“Automotive Tier One manufacturers can now avoid investing in dedicated honing systems for engine cylinder bores up to a certain volume production.”

Kiwa Japan has recently introduced a new horizontal machining center with column traverse structure, called the Triple H40. The table stays stationary, and the X-Y-Z axes ballscrews and roller guides are behind the X-Y axes way covers. This enables a very compact machining area of 43.31 W (1100 mm) × 23.62 L (600 mm) × 31.50" H (800 mm).

The Z axis moves with back-and-forth movements of the column, which assures higher rigidity of the spindle than quill-type spindles. The spindle has six bearings for better stability. The key feature of this model is its ability to support flexible mounting of various fixtures and rotary tables, according to applications. Max workload on table is 2200 lb (1000 kg).

This HMC is well-suited for larger fixturing and also supports good access for automation to the machine. This machine lends itself well to markets where parts are long and need work done on the ends. With the stationary table
design, long workpieces can be clamped firmly to the table and there is no moving of long parts back and forth due to special guarding. Items such as support tables and roller tables can be adapted to the machine easily, to introduce parts from the front or sides.

Four-Axis HMC Adds Honing to Multitasking Arsenal

Production honing is the latest of the so-called smart machining capabilities that have been added to horizontal machining centers. The honing process has been adapted to the H-series four-axis HMC from Heller Machine Tools (Troy, MI), using the Heller out-facing head. The complete machining of cylindrical bores from raw part to precise controllable tolerances in one setup is said to dramatically reduce tooling and machine cost as well as machining times, at least up to a certain volume production. Heller’s NCU out-facing head prepared for honing can adjust the size, taper, surface and tolerance of a bore as it changes the size of the tool during the honing process. A Marposs in-process gage is incorporated into the head.

Heller collaborated with Diahon to program honing cycles that permit helical slide honing. The Heller H series machines are able to create a continuous cross-grind that can otherwise be produced only on advanced and very expensive honing machines. Unlike on honing machines, however, bores with a cylinder form tolerance of just 1 µm can be produced in one setup over a length of 300 mm, for example, eliminating the typical three-pass honing process and minimizing honing cycle time.

Productivity increases are expected to benefit manufacturers of pump housings, con-rods, cylinder blocks or hydraulic control housings. Cost savings result from the short machining times and the elimination of a special machine for honing. With honing on a machining center, the in-feed motion and the speed of the tool can be adjusted while machining occurs. A high degree of automation is possible, and production capacity can easily be adjusted as needed.

“Automotive Tier One manufacturers can now avoid investing in dedicated honing systems for engine cylinder bores up to a certain volume production,” said Vince Trampus, Heller US vice president-sales, “Machining centers offer the total processing flexibility the industry is asking for, and adding the honing process to machining center capability makes the case even stronger.”

Heller H series four-axis horizontal machining centers with NCU out-facing head are capable of honing, adjusting the size, taper, surface, and tolerance of a bore as it changes the size of the tool during the honing process. A Marposs in-process gage is incorporated into the head.

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