

Brains, Not Brawn

Many of the machine tool innovations at IMTS will be rooted in controls, software and ancillary products—not hardware.

► BY LARRY OLSON

Lean times call for lean measures, and U.S. manufacturers know that all too well. Awaiting the upturn in the manufacturing sector, owners, engineers and machinists alike are busy seeking ways to optimize their chip-making operations. Enter IMTS.

Control developers have heard the cries, and many of those exhibiting at the massive Chicago fair will highlight strategies designed to streamline processes and boost productivity. From enhanced open-architecture controls to wireless interconnections to new user interfaces, “soft” solutions to hard problems will pervade the aisles of the largest manufacturing trade show in the Western Hemisphere.

“The main theme at IMTS this year will be lean manufacturing,” predicted Mark Brownhill, manager of machine tool services for GE Fanuc Automation North America Inc., Charlottesville, Va. The emphasis will be on “using the brains of the controls with overall manufacturing systems and communications to reduce setup times and waste.”

Show attendees will be looking for proven technologies, said Jim Fall, president of open-architecture software supplier MDSI—Manufacturing Data Systems Inc., Ann Arbor, Mich. “People visiting IMTS booths will be talking about the real world and . . . saying, ‘I need something that is proven and reliable—a product that will make my business more efficient.’”

CTE staff members contributed to this report.



GE Fanuc



GE Fanuc will display snap-on modules for its VersaPoint distributed I/O system, which connects to a variety of PLCs and PC-based control systems.

In many respects, according to Fall, it is a case of getting back to the basics. "Manufacturing has always had companies that are pioneers in adopting new technology. However, the risk of failure for a new technology is higher right now in manufacturing than anywhere else in the economy. So, there is a greater drive to make sure that things are solid and more production-proven. Our customers are looking at how technology can help them reduce their costs and make their machines run more efficiently.

"In terms of software control solutions, we have found that PC-based, open-architecture control will always have a price advantage," Fall continued.

He also pointed out that there has been more acceptance of open architecture in the marketplace since the last IMTS. While all of the CNC vendors are talking about it, "they all have a different definition of what that is," Fall said.

Opinions about what constitutes "open" range from systems that incorporate no proprietary hardware elements to CNCs that interface with PCs via buses to circuit boards that plug into PCs. Most people, however, agree that an open control allows users to integrate commercially available hardware and software with machine tool CNCs.

Fall explained that understanding control systems and how they process data is important when sorting out suppliers' claims. "When a part program comes in and is parsed, you have to interpolate

multiple axes and update the servos. Data blocks can only be parsed at a certain rate, or the part programs have to be 'drip-fed' into the control. With this situation, it wouldn't matter how fast the servos were updated; the speed of the system would be limited by the rate at which the data could be parsed. Now, systems can parse data more rapidly, and the servo update rate is about 100 microseconds."

Thus, the issue is how fast the axes are interpolated.

"Many specifications state that the interpolated rate at which all the axes are being coordinated is 4 milliseconds," Fall said. "So, with a 100-microsecond servo update, the final bottleneck for the control becomes the algorithm." MDSI's software is designed to interpolate the axes at the same rate that the servo loop is closed.

Taking Control

Brownhill said another major theme at IMTS 2002 will be systems integration. "Ethernet capability and communication will be more important this year," he said. "Serial communication is basic to all controls today, and integrating is the key to keeping up with efficient production scheduling."

GE Fanuc's OpenFactory hardware and software system is designed to help users operate, manage and maintain control systems. Most existing machine tools, with a variety of different manufacturers' CNCs, can be upgraded and integrated. Software solutions help users meet ISO 9001 documentation control standards, develop machine-independent part-processing definitions, minimize setup time and delays, monitor machine performance and schedule preventive-maintenance tasks.

Other communication tools from Fanuc are recently introduced modules for its VersaPoint distributed input/output system, which connects to a variety of programmable logic controllers and

PC-based control systems. The snap-on modules provide higher discrete I/O capabilities, additional analog I/O options and power, and segment terminals with built-in fusing and diagnostics.

The company reports that VersaPoint's flexibility, modular construction and ability to interface with assorted networks, including DeviceNet, Profibus-DP and Ethernet, makes it usable in most control applications.

Mitsubishi Electric Automation Inc.'s new C64 CNC connects to the same networks, as well as Mitsubishi's MELSECNET/10 and CCLINK. The Vernon Hills, Ill., company claims that the C64 provides high-speed and highly cost-efficient control of manufacturing cells, transfer machining lines and rotary index machines. It incorporates all the features and specifications of a high-end CNC with high-level PLC technology.

The C64 is produced with up to 14 axes of control, and one CNC can control up to seven program paths simultaneously. The CNC's graphical user-interface function is designed to shorten debugging time, and an improved diagnostics function is aimed at minimizing equipment downtime.

The latest machine control from Mazak Corp. is the Mazatrol Fusion 640—a combination PC and CNC. The 640 features bi-directional communication with an office computer, process prediction and monitoring as well as results reporting.

Other Fusion 640 features include spindle-load and operational-status records; 3-D solid-model check; tooling auto-determination; accurate simulation of machine contour with graphical display of unmachined workpiece material; graphical checks of ID and point machining; a higher feed rate for complex contours; fine spline; automatic determination of cutting conditions; a library of proven programs; maintenance scheduling; and self-diagnostics/recovery.

According to Neil Derosiers, Mazak's software support group leader, "The new introduction at IMTS this year will be the addition of the Fusion MPro for our new *e*-series Integrex machines. Unlike earlier models that feature high-level milling control, the MPro adds high-

speed machining functions to this product line. This really blurs the line and closes the gap between turning and milling capabilities in one machine.”

Like the Fusion 640, the MPro has the same user interface to provide commonality for the operator, all the way back to the M2 control. Operating on Windows, it has keyboard inputs that resemble earlier controls, so that training time is minimized.

“However, the architecture, motherboard configuration and accessories for the MPro are all totally different from the earlier Fusion version,” said Derosiers. “We redesigned the PC-based control from the ground up to look more like a PCI card. This ensures that it can be easily upgraded in the foreseeable future.” The system also has numerous robust mechanical design features, such as a heavy-duty fan and power supply, to support future upgrades.

According to Bob Cain, product manager at Okuma America Corp., Charlotte, N.C., one of the things his company will introduce at IMTS is the industrial version of its PC-based control. Called Compact PCI, it has been a popular quasi-industrial standard with the telecommunications industry.

Though not a proprietary board design, it includes some customization to upgrade it to Okuma standards. (Okuma outsources the development and production of the motherboard.)

“The system’s open architecture is based on international standards,” explained Cain. “Okuma is continuing to write motion-control software, and the system has programming tools that enable users to develop their own applications. We are working with several other companies to produce a platform that is open and based on a standard that is industrial-hardened.”

The Compact PCI offers protection against obsolescence. Said Cain, “This system will be around for a long time. It



Mitsubishi Electric Automation's C64 CNC connects to a variety of networks and can control up to seven program paths simultaneously.

is easy to upgrade, and changes can be implemented simply by switching chip sets. The CNC platform also features a DeviceNet connection with USB, available for communications, and extensions that are all *de facto* industrial standards.”

The suite of “e-manufacturing” software for the system includes ITPlaza. It allows extended machine monitoring, including all machine activities, such as measuring operator efficiency and productivity. The software is also usable with earlier generations of Okuma’s controls and machines.

All the parts are designed and produced internally, except for the motherboard. “Since PC technology changes so rapidly, outsourcing the board to a PC producer is the right decision,” said Cain. “This enables our company to tap into a resource that has a broader market, so that we can produce the PC-based controls with an economy of scale in the right industrial configuration for machine applications.”

Tony Chiarello, vice president of Hitachi Seiki USA Inc., Congers, N.Y., said that the company will feature CNC systems with Siemens controls, Yaskawa drives and its own software and user screens. One new CNC that will be exhibited is the PCFlexi PC-based control that marries Siemens and Yaskawa technologies.

“The PCFlexi is a joint venture with application to many Hitachi Seiki machines,” says Chiarello. “It has enhanced application with our UUP (universal user port) systems. It doesn’t run Windows, but it has many of the same user-interface features, a mouse control and Hitachi Seiki screens.”

The Seiko Sigma control, which runs on Fanuc hardware, also will be shown on the newly introduced SuperTilt 500- and HighCell 300-series machines, the Hitachi Seiki 250D 4-axis turning cell and the 5-axis, trunnion-type vertical.

Hands On

Mitsubishi Electric plans to showcase its F900GOT series of graphical operator terminals. The manufacturer reports that these touch-screen displays are well-suited to individual machine controls and can be used in a wide range of applications requiring a human-machine interface. A single terminal can replace dozens of hard-wired devices, such as push buttons, digital thumb wheels, gages, pen recorders, pilot lights and others.

“This creates savings in space, wiring and overall maintenance costs,” said Kris Davis, Mitsubishi Electric HMI product manager, “and innovative capabilities provide greater ease of use and machine operation efficiency.” Capabilities include graphic display of temperature process and production information, various alarm, trending and historical functions, and bit and data-register control.

Software features of the F900 series include a bit-map library of commonly used devices. These attributes reportedly reduce project development time, as well as alarm handling, historical graphs,



Mitsubishi's F900GOT series of graphical operator terminals are designed for individual machine controls and a wide range of applications requiring a human-machine interface. Shown is Model 940H.



GE Fanuc

The CIMPLICITY PalmView has bi-directional data capabilities that permit users to interact with their production systems through the Compaq iPAQ Pocket PC.

recipe management, message libraries, alarm banners and printing functions.

The 5.7" panel-mount version, Model 940, is ideally suited for individual machine control panels. And the handheld Model 940H incorporates four additional user-defined function keys, a hard-wired emergency-stop button and a hand-grip actuation trigger to prevent unintended operation.

Another "handy" device will be displayed by GE Fanuc. Its new CIMPLICITY PalmView is a handheld personal digital assistant that incorporates CIMPLICITY production-management software and a wireless Ethernet card. The PDA lets users view—in real time—graphical automation and production data from anywhere in the plant. Plus, the unit's bi-directional data capabilities allow users to interact with their production systems via a Compaq iPAQ Pocket PC.

"CIMPLICITY PalmView is ideally suited for managers, quality technicians and mobile maintenance personnel," said Kevin Roach, vice president of the global solutions business for GE Fanuc. "Now, they have the power to view man-

ufacturing data with the freedom to be located wherever they are most effective. These users have real-time access to the information they need to drive improved productivity and product quality."

Meanwhile, Hitachi Seiki will feature expanded applications for its Seiki FlexLink Ethernet connectivity, which includes wireless networking.

Bringing true "e-manufacturing" and productivity control to the shop floor, the system utilizes locally networked PCs (wired or wireless broadband) to provide remote, real-time communication between management software and

machine tools.

Hitachi Seiki vertical-machining and turning-center controls feature special software and a UUP Ethernet connection that provides bi-directional communication between the CNC and an external PC. The standard RJ45 Ethernet connection gives users expanded options for connecting to a LAN or a variety of devices, including PDAs and cell phones.

Probing Answers

Besides helping users track what's happening on the manufacturing floor, IMTS exhibitors will offer products that make it easier to monitor the quality of the parts they produce.

IMTS will feature more integrated

Control software simplifies grinder installation

The 3-axis centerless grinders Tru Tech Systems builds practically install themselves. Well, not really, but the software that comes standard with each grinder provides detailed visual and audio setup instructions.

"We could just ship the machine and the customer could install everything—from the control to the coolant tank—by himself," said the company's sales manager, Toby Roll.

Tru Tech, Mt. Clemens, Mich., spent 18 months developing the software, which it introduced earlier this year. The company plans to make the software available on its OD grinders within a few months.

The new offering complements the Pick-N-Place talking software the company introduced 2 years ago. It teaches an operator, step by step, how to program and run parts in a couple hours. Programming complex shapes, such as contours, reportedly can be learned in less than 5 minutes.

The opening screen prompts the operator to create a program by first naming it. The screen displays a library of 24 shape icons, ranging from simple square- and round-end figures to more complicated forms. Selecting a particular icon by clicking on it creates the program commands required to machine the part. "Help" screens

are available, as is a movie loop portraying the operation.

The next screen enables the operator to program the system by entering coordinated axis movements directly in the machine control. The screen that follows displays an inventory of programs and programmed forms for recall and subsequent execution. An additional screen enables the operator to make calculations using appropriate geometric figures (e.g., a triangle) to determine machine table coordinate locations and travel distances.

Finally, a scheduling screen allows the operator to control and monitor the timing of all operations, including load and cycle times, cycles per unit and cycle count. Provisions are made for starting, stopping and resetting all timed functions, as well as for making a printed record to document the program and machining operations.

"Pick-N-Place is going over like crazy," said Roll. "Now companies don't have to send their people somewhere for 2 weeks to be trained. They can train them in their own shops."

—L. Olson

For additional information on Tru Tech Systems, call (877) 878-8324, visit www.trutechsys.com.

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probing and on-machine metrology, according to GE Fanuc's Brownhill. Typically, integrating a probe with a control requires the CNC to be modified and probing macros to be written. As a result, "most probes just sit on the shelf, and controls not set up for probing have to be retrofit in the field," Brownhill explained.

To provide turnkey solutions for its customers, GE Fanuc had to become "probe-smart," Brownhill said. The outgrowth of the educational process is that now all GE Fanuc controls come "probe-ready" and include the macros needed to drive the probes.

Brownhill pointed out that with probing becoming part of the general machining operation, adaptive machining is possible. Machining parameters can be updated to compensate for changing conditions. With probing macros in the control, measurements can be interleaved with the machining operations.

"Job shops need to prequalify new tooling, and they just don't have the time with more complex setups," Brownhill stated. "They need more help in locating work on the table and reducing setup time—especially with low-volume production."

Another key use for on-machine probing is error-proofing finished parts. This is as important today for low-volume shops as it is for manufacturers further up the ladder. "Complex castings cost thousands of dollars, especially in the aircraft engine business," Brownhill said by way of example. "You have to determine that the right casting is being used to start, in the right locations, with the right parameters.

"Today, on-machine metrology is as accurate as taking the part to a CMM for measurement and inspection," he concluded. "There is no reason that this can't be done more quickly, more accurately, right on the machine."

MDSI's Fall said, "At the end of the day, if a technology cannot deliver a quick payback, customers are going to go somewhere else."

Fortunately for those who attend IMTS 2002, "somewhere else" may be just 10' away at the next exhibitor's booth.

About the Author

Larry Olson is a freelance writer who has written extensively about manufacturing-related topics.