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The Push is On

04/13/2009

Edited by Charles Bates, senior editor

Mechanically, most machine tools can run significantly faster than shops operate them. The reason is that, in most cases, original controllers are unable to process data fast enough to push machines to their design limits.

A 20-year-old vertical machining center, for example, may be able to move at speeds of 300 ipm to 400 ipm. But if its CNC is unable to process data fast enough or read in large amounts of data at high speeds, the machine will not accurately run anywhere near those top-end speeds.

This is why entrepreneur Carlo Miceli developed the MTI constant velocity controller (CVC). The system provides more processing power, smoother machine movement, and an ability to run CAM software directly on the machine's controller terminal. But most importantly, it pushes actual machine times closer to programmed time.

"Programmed machine feeds are reached only under near-perfect conditions and then for only a few seconds at a time," Miceli said. "There are a lot of reasons for this, but what is important is that the average machining speed is only 30 percent to 40 percent of what the programmer specifies. CVC systems typically attain average speeds of 80 percent to 90 percent of what is programmed, or two to three times faster."

Miceli's company Miceli Technologies Inc. builds several major advancements into its CVC controller. These include up to eight interpolated axes and a program execution speed of 50,000 blocks per second – versus the 2,000 to 3,000-blocks-per-second speeds of even the best CNC controllers.

The CVC controller packs 80 highaccuracy smart buffers for look-ahead algorithms as opposed to the CNC norm of a few dozen lines of code – in effect, just one buffer. There are 4 million maximum (servomotor) encoder counts per second, a measure of maximized closedloop feedback, and the system achieves 15-digit motion control accuracy and a minimum resolution below one micron.

Another significant advantage of the CVC controller is that it retrofits to older machine tools to save costs for shops such as Fidelity Machine & Mould Solutions in Calgary, Alberta.

The shop is a major source for injection molds, and about 50 percent of its work is general and CNC machining. And as with most other shops, sound creative business decisions spring from insufficient cash at Fidelity Machine & Mould Solutions.

Instead of buying new, the shop purchased a low-cost used 1997 Fadal VMC15 vertical machining center retrofitted with the CVC by Miceli Technologies. The system gives the shop unlimited processing and communicating capabilities, and it can enter any size program without having to worry about taxing the machine or not feeding it with data fast enough.

"Retrofitting a well-cared-for, used mid-sized VMC costs about $120,000. That's about one-sixth of the $750,000 installed price of an equivalent new machine – a price way beyond our budget," Jeff Litster, one of the co-owners of Fidelity Machine & Mould Solutions, said. "We got a lower-cost machine that will perform better than high-end new machine tools."

While the hundreds-of-inches-a-minute speeds offered by CVC machining with look-ahead capabilities are beneficial, high accuracy is just as important, if not more so, to Fidelity Machine & Mould Solutions.

Most of the shop's jobs are small. For example, the injection-mold core and cavity for an over-mold are about the size of a paperback novel, and this type of work is a mainstay at the shop, with three or four such jobs per week.

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According to Litster, these small blocks – often measuring 6 in. by 8 in. by 3 in. – actually present more of a problem than most machining because there is so little working area inside the core and cavity. Small cutters, tight radii, and difficult geometries also add to the challenge. The shop uses ball-nosed cutters as small as 0.015 in. in diameter.

“This is machining with almost no clearance for the cutter, so extremely precise control of all cutter movement is essential,” pointed out Litster.

The shop also makes tooling for several other types of molds besides over-molds, and surface finishes are always critical. Any imperfection in the molding surface will be picked up in the finished product, so the smoothest possible machine motion is needed when making finishing passes.

The controller lets Fidelity Machine & Mould Solutions program cutter paths with tighter tolerances, which provides more control over the cutter and helps generate better surface finishes. When using other machines without the CVC controller, the shop has to open up the tolerances and slow them down so much to keep them from violating the surfaces.

In addition, CVC reduces cut times by as much as one-third, and some onehour programs now run within 40 minutes, with better surface finishes and longer cutter life.

With the ability to install CAM software on the same CPU and interface as the controller, the shop lessens the amount of travel time between work center and machines, but also eliminates any reason or excuse to run a program that is less than perfect. This not only boosts efficiency, it helps operators understand the cutting tool and program limitations better. Operators program closer to target parameters the first time.

The next big decision at Fidelity Machine & Mould Solutions is when to retrofit its two other existing vertical machining centers, one of which is a vertical ram-type machine.

“The success of the CVC on the Fadal convinced us,” Litster confirmed. “With the Meceli Technologies controller, we have something unique to the Calgary market. We definitely plan to use its capabilities in our marketing.”

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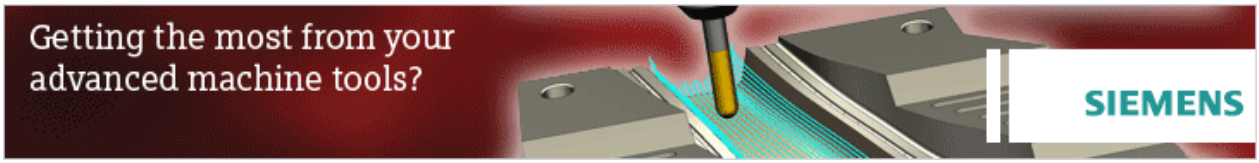

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Think Outside the Box and You Get a New Box

Larry Haftl
09/05/2008

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When Carlo Miceli, president of Miceli Technologies Inc.

(http://www.americanmachinist.com/Classes/Continue/ContinuePage.aspx?HBC=GlobalSearch&PN=Article-Think+Outside+the+Box+and+You+Get+a+New+Box&TURL=http%3a%2f%2fwww.miceli-technologies.com) and his engineering design team set out to create a new CNC machine tool controller six years ago, they set out to raise the performance bar and change the entire paradigm of what a machine tool controller should be.

Six years later they believe they have succeeded, and they say that their MTI controller drives machine tools twice as fast and twice as efficiently as other controllers on the market.

“Our goal was to develop a controller that truly gives the user a competitive advantage,” Miceli said.

“We also wanted to keep it simple. One of our early reviewers said our controller has a ‘Honda feel’ to it, meaning that it is slick, simple and has a natural, intuitive feel to it. It doesn’t frighten people with 200 push buttons, 90 percent of which never get used. And it drives machine tools at a constant velocity that is at least twice as fast as the other controllers,” he added.

Miceli and his team build the controller from the ground up using computer architecture that is different from the architecture used by the rest of the industry.

“The controller is a delicate balance that uses existing mainstream computer technology with proprietary components, but in a completely different and unique architecture,” Miceli said.

The controller has two separate operating environments – one for the machine operator and the other for the machine itself.

The operator environment uses the Windows XP Pro operating system to enable applications that run under Windows XP to be run on the controller without interfering with what is going on in the machine environment.

A machine operator can be answering email, using a Computer Aided Machining package to generate toolpaths and post process into G-code, or playing solitaire while the machine is running a different program and cutting metal. Unlike other controllers that use a single microprocessor to service both environments, the MTI controller has two completely separate microprocessor systems.

What is most important about the MTI controller’s architecture is that it can process data as much as 25 times more efficiently than all other controllers. Data is processed by a controller in blocks, and the speed of a controller can be measured in how many blocks of data can be processed per second.

The current industry average is about 2,000 blocks per second with a low of about 600 blocks per second and a high of less than 6,000 blocks per second when doing 3-axis applications.

The MTI controller can process as many as 150,000 blocks per second in a 3-axis application and 50,000 blocks per second in an 8-axis simultaneous application.

Miceli uses an analogy of a car driving along a twisting mountain road for the first time to explain the impact of that increased processing capability.

“With other controllers it is like the driver of the car has to go slowly while he looks ahead to see how the road is twisting and turning, but with our controller the driver immediately and completely knows the entire road before he even turns the car’s ignition on,” he said.

Analogies might help understand the potential, but the proof is in the actual machining. The MTI controller consistently drove a machine tool running the Mercedes test twice as efficiently and cut the cycle time in half. The Mercedes test was developed by Mercedes Benz as a standard test of complex machining, and it is used to compare the performance of different machine tools.

“The more complex the parts being cut, the more efficient our controller is,” Miceli said.

Miceli offered an explanation for the reason that a machine tool equipped with his controller is only twice as efficient as other controllers when it can process data as much as 25 times faster.

"The fact is that, until now, the limiting factor in machine tools has been the electronics controlling the tool. In general, machine tools have always outpaced the controller electronics available to manage the tools. Drives and motors also are way ahead of controller technology. The reason that our controller operates so much faster than other controllers — but we only get twice the efficiency and half the cycle time — is because for the first time we have a controller that has the potential to drive a machine faster than current machines can go," he said.

"If a tool design engineer can figure out a way to make a machine cut 10 times faster than the current machines can, then our controller is already waiting to drive it," he added.

Miceli said other controller companies are using old architectures that their engineers are used to working with.

"Even the newer controllers were designed by engineers who are used to working with the old architectures. Like most product development today, controller designers are looking to add more bells and whistles to existing architecture rather than find a faster, more efficient and simpler architecture.

"If you are an established company with a product that has been successful for 20 years or more, then that makes sense. But if you are a new company, such as ours, then our need is to innovate in order to differentiate, and that is exactly what we have done. The net result is that any machine using our controller will be twice as efficient and take half the cycle time as the same machine cutting the same part using any other controller," Miceli said.

At the moment, the MTI controller is available only on the GBI Cincinnati Inc. (http://www.americanmachinist.com/Classes/Continue/ContinuePage.aspx?HBC=GlobalSearch&PN=Article-Think+Outside+the+Box+and+You+Get+a+New+Box&TURL=http%3a%2f%2fwww.gbcincinnati.com) Revolution CV4020 machining center, but Miceli is talking with other machine tool makers and hopes that the MTI controller will have wider implementation in the near future. The MTI controller will be demonstrated at IMTS 2008 at the GBI Cincinnati Inc.

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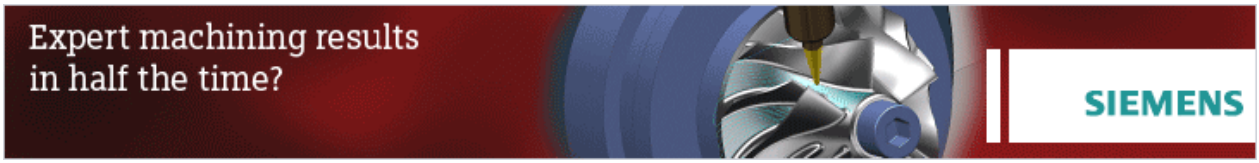

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Builder Claims More Efficient Machine

AM Staff
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(http://www.americanmachinist.com/Classes/Continue/ContinuePage.aspx?HBC=GlobalSearch&PN=Article-Builder+Claims+More+Efficient+Machine&TURL=http%3a%2f%2fwww.gbicincinnati.com) may well be a company to watch in the future.

The five-year-old firm recently announced that it will build a line of machine tools under the Revolution nameplate and control those machines with the MTI constant velocity control. The machines will be built in Michigan.

According to Kevin Bevan, president of GBI, the MTI control is 25 times more efficient than any control that exists in the world today. With a minimum block processing capability of 50,000 blocks per second in eight-axes simultaneous movement, the Revolution will process parts complete in half their cycle times without any alteration of a customer's current part program because the machine operates at a constant velocity. The current industry average is 600 to 2,000 blocks per second in 3-axis applications.

The machine uses 80 internal high-speed buffers that continuously shuffle programming data through its proprietary software to optimize the control's speed and efficiency for productivity gains of 100 percent or more.

The first Revolution model is the CV4020 vertical machining center that milled the Mercedes Test in excess of 200 ipm using the MTI control.

Carlo Miceli, president of Miceli Technologies, developed the MTI control and said it was based on concepts dramatically different from those of other CNCs. The MTI control has been available for several years, but this is the first time that it is being designated as standard equipment for a line of machines. Also, GBI plans to offer the control as a retrofit package for existing machines.

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