

Working Software **HARD**

CAM programs offer flexible features that allow parts manufacturers to reduce programming time and realize other benefits.

Setup time. Cycle time. Loading/unloading time. Parts manufacturers are always trying to reduce those times. Before a machinist touches a workpiece, a cutting tool or a fixture, though, there's the time needed to prepare a part program. To minimize that time, machine shops should make full use of CAM program features.

Making Macros

"Seek opportunities to automate repetitive tasks."

That advice to CAM software end users, especially new ones, comes from Steve Sivitter, director of worldwide sales for Planit, Southfield, Mich., which develops EdgeCAM.

It's advice that Vic Belna of Coldwater (Ohio) Machine Co. LLC would second. Belna heads the machine shop's technical R&D department and estimates that automating repetitive tasks by writing macros saves the company 10 to 75 percent of programming time, depending on a part feature's complexity.

A macro is a subroutine in a CAM program and can be customized by an end user to perform a variety of machining operations, commonly repetitious

JD Machine used its CAM software's ability to easily rearrange the order in which it machined this workpiece's several intersecting holes, allowing the machine shop to determine the most efficient way to create the intersections with the least amount of variance and meet the holes' required tolerances.

operations on a family of parts. For example, a macro can be customized for drilling a hole, but it isn't confined to that process or to a specific cutting tool. A macro's parameters, like tool size, Z-axis level and cutting depth, can be changed, providing flexibility.

Macros permit quick, automated creation of part programs. Consequently, a machine shop can save a lot of time and labor with CAM software that allows programmers to write macros. "This is how you get [CAM software] to do your things your way," said Bill Gibbs, president of CAM software developer Gibbs and Associates, Moorpark, Calif.

Belna provided an example, describing the instructions contained in a macro written for Coldwater's lathes. The macro's code instructs a lathe to move the tailstock on its slide to a specified distance from the chuck face, advance the center into the workpiece,

move the tailstock up into position for turning the workpiece, return the tailstock home after it finishes its machining and stop the spindle.

"That is one button push; that is not several different M codes," Belna said.

Macros, subroutines in a CAM program that can be customized by an end user to perform various machining operations, permit quick, automated creation of part programs, saving a machine shop time and labor.

"I was able to automate it and save a lot of time."

The ability to write macros has been a feature in various CAM programs for several years. For example, Gibbs and Associates first included the ability in GibbsCAM 2004 and recently improved it for GibbsCAM 2007 to support multitask machining.


Coldwater gained the ability to write macros when it changed its CAM software to EdgeCAM in 2004. The shop's previous CAM software was no longer being updated, and technical support for it had been discontinued. Cold-

water's first EdgeCAM software was Version 8.5. It now uses Version 11.5, released in mid-2007 and expects to soon upgrade to Version 12.

The ability to write macros comes in handy at Coldwater, and Belna cited a job in which macros were especially useful. The shop machines gray iron castings to create gang heads that a



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customer uses in dedicated, high-production lines for making automotive parts. Each gang head, a gearbox with spindle mountings, uses 30 different types of spindles for boring, reaming, tapping and other operations.

Coldwater manufactures the spindle mounts via 12 holmaking operations. The holes differ in their depths and diameters and in their manufacture, some are cored and some aren't, for example.

Coldwater created the programs for its 12 holmaking operations based on a set of macros, saving itself programming time. Also, the machine shop stores its macros on its computer network's server rather than on the separate PCs. That way, when a macro is updated, every machinist using that macro will use only the updated version.

For ease of use, Belna created pull-down menus for various part features, like a menu for threaded holes of different depths and diameters. The menus allow a machinist to more quickly finalize his part program and have the post-processor convert it into G code for a machine tool to execute.

"You've got full G code in 30 seconds," Belna said.

Using a Post

Post-processors can be complicated software. Besides G code, a post-processor also converts portions of a part program into M code. Both types of code must be executable by a machine tool's controller. Also, the post-processor's outputted G- and M-code program shouldn't require any manual editing after its creation.

If a post-processor isn't set up correctly, it won't output useful machine tool programs. "The system won't work very well at all," said Chuck Mathews, vice president of marketing and R&D for CAM software developer DP Technology Corp., Camarillo, Calif. A machine shop could then find itself manually editing a lot of G code and doing trial runs on machine tools.

Consequently, post-processors may be best set up by companies that develop them as part of CAM software or as separate programs.

After it's set up, though, if a post-

processor can be customized in-house by a parts manufacturer, that ability can save programming time.

Coldwater uses its CAM software for in-house customizing of its post-processor programs so no part has to be run on a particular machine tool. For example, if a lathe must be shut down because of a malfunction, Coldwater can shift the workpieces to another lathe and repost the program to

it, even if the lathe is a different brand with a different brand of controller. That flexibility contributes to machine shop efficiency.

"Can you imagine what kind of nightmare it would be if we had to go back to our reseller every time we had to write a post?" Belna asked. He added that Coldwater's reduced programming time allows it to reduce its lead times for customers.



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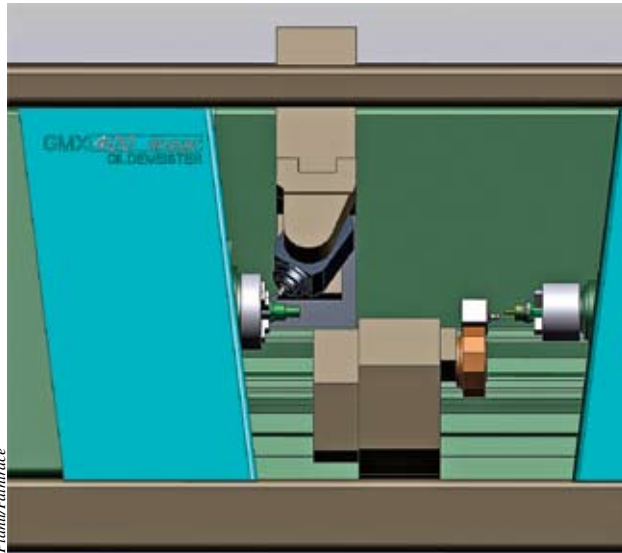
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Also, Coldwater's reduced programming time with EdgeCAM allows it to employ just one full-time programmer. The reduced time permits the person to stay ahead of seven 2- and 2.5-axis machining centers—no mean feat given that Coldwater mainly machines various low-volume jobs.

"We don't do any production here," Belna said. "A large run for us is two parts, three parts." Coldwater instead does design-and-build work, produces build-to-print parts and performs custom machining. It serves the aerospace, appliance, automotive, beverage, energy and integrator industries.

Gibbs said as machines become more complex, post-processors for them become more complex. And, both he and Sivitter said they've noticed a trend toward increased use of higher-end equipment, such as multitasking machines and 5-axis machine tools, among CAM software end users.



A machine shop can reduce programming time via CAM software with a post-processor that allows the shop itself to change the post-processor's output programs, including those for higher-end machine tools, such as the mill/turn center in this CAM simulation.

Gibbs added that end users are obtaining these higher-end machines to save money by reducing the labor costs in their operations.

A new 5-axis multitasking machine was the reason for JD Machine's switch

from its previous CAM software to Esprit 2008, the latest version, in November. The Ogden, Utah, machine shop had ordered the new mill/turn center and decided it needed a more robust CAD/CAM system to support



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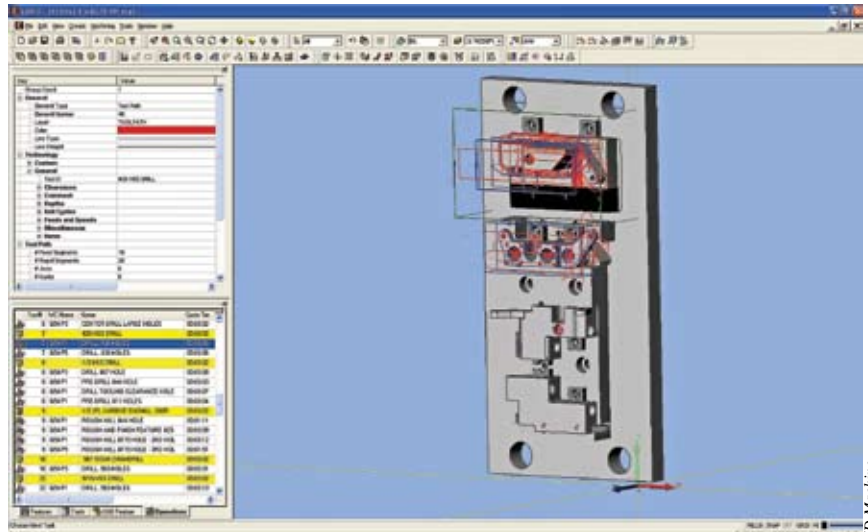
the machine.

The decision was partly based on the shop's experience using its previous CAM software with its 4-axis horizontal machining center. Matt Wardle, JD Machine's president, said the previous software was satisfactory when used with machine tools with three or fewer axes, but wasn't adequate for higher-end machining.

However, the shop doesn't confine Esprit 2008 to higher-end machining. "We use it throughout the entire shop," Wardle said.

JD Machine also wanted more flexibility from its CAD/CAM system's post-processor. Like Coldwater, it wanted to be able to make changes itself to the post-processor's output G code. The shop couldn't make changes using its previous CAM software's post-processor; it had to have a CAD/CAM company make them. "It was very cumbersome," Wardle said about the procedure. "It took forever."

After purchasing Esprit 2008, JD Machine programmers received on-



JD Machine

Parts manufacturers can save programming time if their CAM software permits easy switching between automated generation of toolpaths, the red lines above, and manual generation and adjustment of them.

site training from DP Technology and can now change the post-processor's output programs in-house.

Choosing Your Own Path

JD Machine also wanted more flexibility from another aspect of its

CAM software. "We wanted more control over our cutter path," Wardle said. The shop's previous software provided few options for changing toolpaths. "It makes a lot of the decisions for you," Wardle said.

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generation of toolpaths can be a benefit because it can save programming time, but it can be an obstacle, too. For example, JD Machine might want to change a path to improve a workpiece's surface finish. With its previous CAM software, though, changing a toolpath required trial and error. A programmer would know what toolpath he wanted but might have to enter several different parameters before the software's toolpath-generating routine gave him that desired path. "You never knew what you were going to end up with," Wardle said.

Using Esprit, JD Machine could dictate toolpaths, eliminating trial and error and thereby reducing programming time. "We've seen a 25 percent reduction in programming time," Wardle said.

EdgeCAM also has features for automated generation of toolpaths, but end users can override what the software indicates is the best path. Michael Keating, production manager for MPC Products Corp., said he appreciates the ease with which MPC can change a toolpath in EdgeCAM.

The following companies contributed to this report:

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DP Technology Corp.
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Gibbs and Associates
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JD Machine
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MPC Products Corp.
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Planit/Pathtrace Ltd.
(248) 356-8800
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The Skokie, Ill., machine shop switched from its previous CAM software to EdgeCAM in 2000. Last summer, it updated to EdgeCAM's new Version 11.5 and is considering Version 12. MPC uses the CAM software for its wire EDMs, 3- and 4-axis milling machines, 2- and 3-axis lathes and Swiss-style machines.

Besides flexible controls for creating toolpaths, EdgeCAM automatically

adjusts a part's toolpath if its geometry changes, basing the new path on the new geometry, such as a part feature that was moved. "It knows what and where you moved it," Keating said.

With its previous CAM software, MPC might have had to rewrite a portion of the program because of a part change due to a redesign, for example. EdgeCAM's automatic toolpath adjustment eliminates MPC's concern

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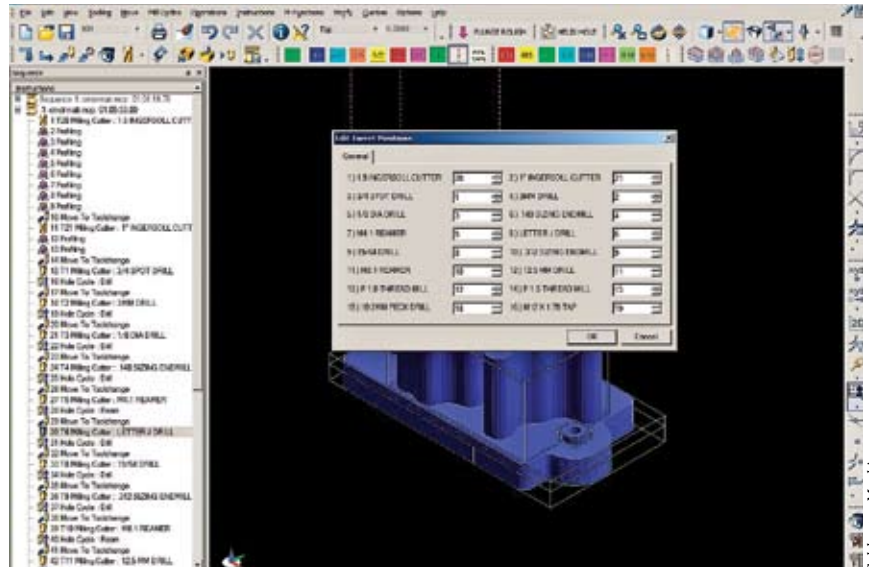
“As long as the geometry is correct, the toolpath created will be accurate,” Keating said. “Since the toolpath is associated to the geometry, we can change or adjust programs much more efficiently.” The reduced programming time benefits MPC’s customers by shortening lead times.

Reordering Operations

Besides rewriting portions of a program, parts manufacturers may need to resequence a program’s operations. Depending on its capability, CAM software can make reordering of operations easy.

Esprit creates tiles for discrete machining operations, such as for drilling and pocketing. A programmer can then arrange all needed tiles into a sequence of operations. This feature allows JD Machine to change a process’ sequence of operations more easily with Esprit than it could with its previous CAM software.

For example, a programmer may



A CAM programmer able to easily resequence a part program’s operations can reduce his programming time, contributing to his machine shop’s productivity. Using the above software, a programmer can resequence operations in the list at left by dragging and dropping individual operations with his mouse and cursor.

write a job’s process program without a roughing operation because he thinks the finishing operation would be sufficient for the workpiece and would reduce cycle time. The job’s first article

may lack the needed surface quality, though, so the programmer has to add a roughing operation.

“Your programmers are taking their best guess on how it’s going to run,”

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Wardle said. "At times, you're figuring out as you go, especially with the most [difficult-to-machine] metals."

With Esprit, the programmer can create the needed roughing operation, drop it into the right spot in a sequence and generate a new set of G code. He couldn't do that with the shop's earlier CAM software. Wardle described that software as creating part programs in which the operations were interconnected, so changing a sequence was more than dropping and generating.

"You had to start at the front and roll through the entire sequence," Wardle said.

Esprit's ability to more easily change a sequence reduced JD Machine's programming time for making changes. Wardle cited an aerospace job in which

JD Machine was machining a jet engine component from Inconel. He estimated that reprogramming took 80 percent less time than it would have using the shop's earlier CAM software.

The resequencing was needed because JD Machine was moving the repeat job to its new multitasking machine. The move allowed the shop to stop profiling the component and instead machine it using 4-axis simultaneous milling.

The shorter reprogramming time made it easier for JD Machine to get the time savings it was after with the move. "It cut the machine time in half," Wardle said. "It went from 30 minutes down to 15."

Cascade Effect

Besides reduced programming time,

parts manufacturers making full use of CAM features may benefit from secondary effects.

For example, JD Machine's use of Esprit 2008 increased part program quality. Programmers didn't have to refine the programs as much after creating them. "Setup time is improved because the quality of the program is better," Wardle added.

Also, better programs have led to improved part quality, including first-article quality. JD Machine programmers need to make fewer changes in part programs after machinists manufacture a job's first article. Wardle said that accuracy is also more consistent from part to part than it was with the shop's previous CAM software. Cycle times are shorter, too. △

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