



Machining

What It's Really Like to Adopt 5-Axis CNC Machines

Holly B. Martin | Aug 07, 2018

What's it like for a shop to make the move to 5-axis machining? We spoke with Columbus McKinnon and Leighton Machine & Tool to find out.

The benefits of 5-axis CNC machining are well-known, including decreased setup time and reduced scrap, as well as increased part accuracy and productivity. But what does it take for a shop to make the move to 5-axis machining? To get a real-world view, we spoke with Bobby Widener, of Columbus McKinnon (CM Hoist), and Jacob Leighton, CNC shop supervisor of Leighton Machine & Tool.

Leighton has been running 5-axis machines since 2012, when the company bought its first 3+2 machine. The company's most recent purchase was a full 5-axis lathe and mill combined. CM Hoist owns both a Mazak i200 Integrex and a DMG Mori Seiki NLX 2500.

Challenges and Solutions: CNC Programming, Toolpath Verification

Widener cautions that programming could become an issue a shop will have to deal with when onboarding a 5-axis machine.

"I was more familiar with the MAZATROL programming language, but the Mori Seiki machines are pretty complicated, running everything under the FANUC language, with G- and M-codes," he says.

Programming was an issue for Leighton, as well.

"When you're running a full 5-axis, there are a lot of things going on in the machine and on the CAD/CAM side of it that all need to talk to each other just right," Leighton says. "Then you've got to worry about how you're holding on to the part, and watch your tool length—so there's a lot to wrap your head around."

To ease his way into 5-axis, Leighton looked into 3+2 machines and found that he could write multiple 3-axis programs, telling the machine to rotate between each program and lock into a new tilted position to work the different faces. He found this was a lot easier to implement until they were ready for full 5-axis work.

Eventually, Leighton Machine purchased a DMG CTX gamma 2000 TC, which allows 6-sided complete machining.

"The only real headache we had when we finally made the jump to full simultaneous machining was looking for CAD/CAM software that would drive it accurately," Leighton says. "We went to a vendor with our machine and the controller, and they delivered a turnkey solution."

If you're planning on doing a lot of full 5-axis work, Leighton also recommends looking into toolpath verification software, to avoid the risk of crashing a machine or gouging a part.

Custom Hobbing Inside a Multiaxis Machine

A gear hob is a cylindrical rotating tool with multiple cutting edges. The process of hobbing a gear requires the hob and the workpiece to rotate simultaneously in a coordinated dance, creating curved gear teeth using straight cutting edges. It's this complex geometry that suggests hobbing would be a perfect application for a multiaxis machine.

CM Hoist uses gear cutting machines but also hobs on the company's two multiaxis machines, a DMG Mori Seiki NLX 2500 and a Mazak i-200 Integrex.

"When CM Hoist first got the Integrex, an engineer really wanted to hob inside the Integrex," says David Meadows, a metalworking specialist for MSC who led the tooling-up process with CM Hoist. "I contacted Mazak, but they didn't recommend it."

The reason, according to Meadows, is that when hobbing, the machine is in between centers on the hob itself, and in the Integrex, the hob is not supported on the cutting end.

Without that support, vibrations can lead to a poor finish, but Meadows was adamant.

"So we actually had a local company named Master Model Craft build a custom hob driver for that machine, and I think CM Hoist has the only Integrex in the U.S. hobbing inside of it," Meadows says.

Different Tooling Requirements for 5-Axis Machining

One benefit of a 5-axis machine is that it can make deeper, faster cuts because it rotates the workpiece so that it remains tangential to the cutting tool. According to Widener, this means the CAD/CAM programs can use the same tool for a range of cuts, without requiring multiple-size tooling.

"We've made sure we didn't have to have seven different end mills—we use just a couple of end mills to do everything we need to do," he says.

"Because you can access five sides of a part, 5-axis also allows you to shorten your tool lengths," Leighton says. "This makes for a more rigid tool, which allows you to run faster and achieve better surface finishes."

There's so much more to 5-axis machining. Get the highlights in "8 Important Facts About 5-Axis Machines and High-Performance Machining Centers."

Choosing a 5-Axis Machine

“My advice would be to learn the full capabilities of the machine you want to buy, and make sure that you have the CAD/CAM support to run it, because when you get to the 5-axis, you’re relying almost solely on software to drive it,” Leighton says.

And, he says, when you’re looking to purchase a 5-axis machine, be aware of your shop’s typical part weight and size.

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“These machines seem to come in two basic types—what I call ‘table-table,’ where you have two rotary axes on the table and you’re moving the part, or ‘head-head,’ where you’re rotating the tool to the part,” says Leighton. “When you get into large mold-making applications, where weight becomes an issue, you’d want to use the style where you’re rotating the tool, rather than a large part.”

CM Hoist manufactures a range of components on its 5-axis machines, from 1-inch hood collars all the way up to five-pocket lift wheels for 2-ton hoists.

“You have to evaluate the type and number of parts you make, before you consider one of these machines,” Widener says.

“We’re in between a job shop and a production shop, running anywhere from 50 to 100 parts at a time, so we do a lot of parts changing,” he says.

“We found that with both of our 5-axis machines we could combine them with a lot of our bar-fed work more than what we had originally thought,” Widener says. “It saves time, it saves multiple setups and it saves manpower for moving the part around, because a part that we now run under one setup could have gone across as many as two, three, maybe four other machines.”

What hurdles do you think you need to overcome to make the move to 5-axis CNC machining? Share your stories.