

Multiaxis machining myths

By Karlo Apro, CNC Software Inc.

Many misconceptions exist regarding 5-axis machining. This column will dispel a couple of them and explain when it makes the most sense to use multiaxis machining.

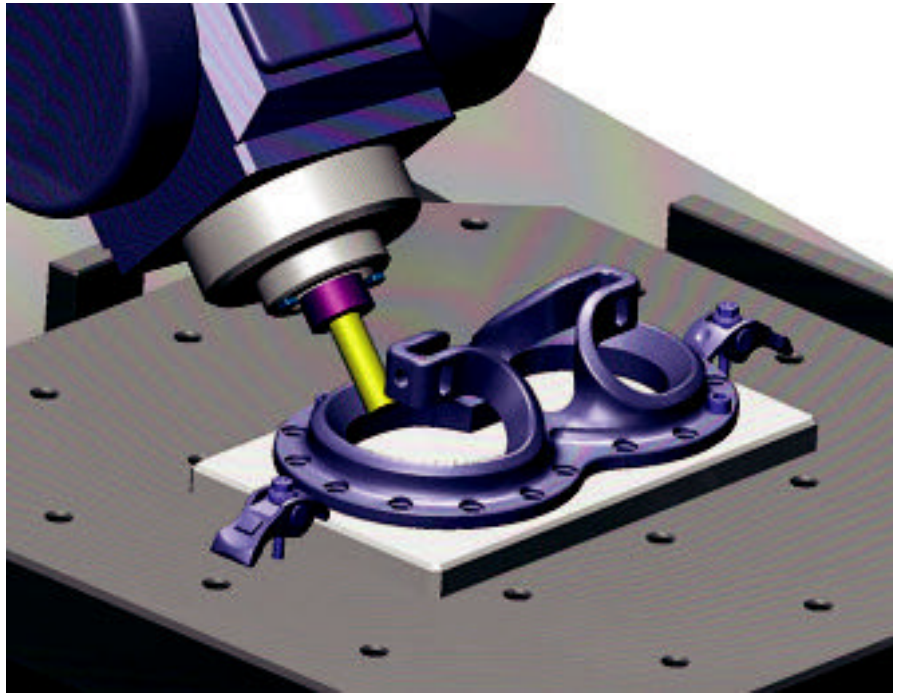
Misconception No. 1: 5-axis machining is not for me; I do simple parts.

Most people associate the term “5-axis” with complicated motions and programming techniques. This view is reinforced by visits to trade shows where attendees see machine builders and CAD/CAM vendors showing their most complicated creations, including impellers, racecar engine heads and induction pumps. Most 5-axis users never make those types of parts. Shops typically machine parts using simple 3-axis drilling, contouring and pocket milling routines, while rotating the part occasionally in a rotary indexing mechanism.

Elaborate parts can be machined by applying 3-D surfacing toolpaths and engaging the part from different angles using an indexing rotary table. Using a multiaxis machine greatly simplifies the motions required, the programming effort and the amount of fixturing needed for machining complex workpieces.

Many shops are making parts by moving them manually to different fixtures on 3-axis machines. Compared with this procedure, production can be increased significantly without much effort by using a 4- or 5-axis machine tool. If a single- or dual-rotary indexing table were added, only slight edits would be needed to the CNC-code files.

Moving to multiaxis machining re-



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Moving to multiaxis machining requires thinking in 3-D instead of in a flat plane.

quires thinking in 3-D instead of in a flat plane. Once you enter the multi-axis realm, new doors will open for your shop. Your company will quickly become more adept and able to tackle more complex work.

Misconception No. 2: Multiple-axis CAD/CAM is too complex and expensive.

That may have been true in the past, but not anymore. If you own a CAD/CAM system, there is a good chance you already have 5-axis positioning capabilities. Most CAD/CAM systems include these capabilities in their base packages. Many times, it is just a matter of training to get up and running.

When shopping for a CAD/CAM sys-

tem, make sure to choose one from a reputable company with a commitment to training and local support. Remember that a CAD/CAM system is just another tool in your tool belt. You can buy fancy tools that are capable, but they are worthless if you don't know how to use them. Having local support may be the most important feature of your new tool.

If you do a lot of simultaneous multi-axis work, the CAD/CAM system is only a small cost factor. More training will be needed, but you will be able to charge almost double for your hourly machine time. The “hard to use” part always comes down to training. Think back: Was it easy to learn how to operate your first CNC machine?



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Don't enter the multi-axis world by starting with a complex, simultaneous job. If you own a 3-axis machine, start with a single- or dual-rotary table and apply indexing techniques. You will make parts faster and more accurately, and you will be able to invest in more equipment. When you decide to buy new equipment, see if you can bundle a CAD/CAM purchase with the machine's purchase order. This is also a good time to make sure the CAD/CAM system speaks your specific machine's language—in other words, that it has the correct post-processor.

Multi-axis machines can reduce setup time, eliminating costly and time-consuming custom fixturing for secondary operations. Most parts can be manufactured in one or two setups on a multi-axis machine.

Every time you move a workpiece from one fixture to another, there is a

risk of misalignment—either during the setup itself or during machining. It is easy to build up, or stack, errors between machined surfaces when they are milled in multiple setups. Indexing rotary tables and dedicated multi-axis machines can allow use of shorter and more rigid high-speed cutters than may be possible on less sophisticated machines. More aggressive cuts can then be taken at higher spindle speeds and feed rates while high levels of accuracy are maintained.

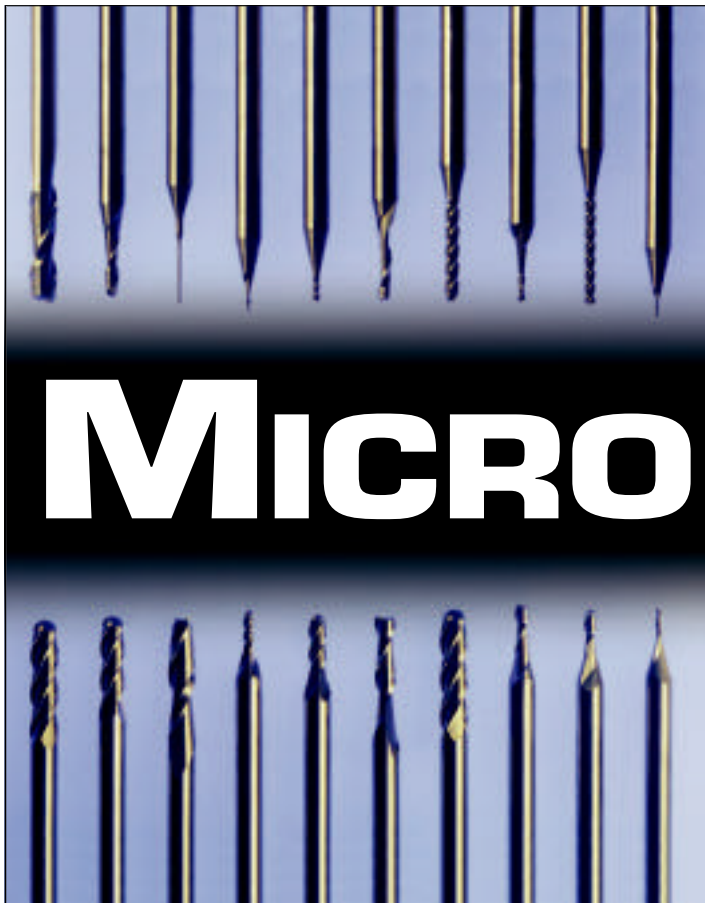
Using shorter tools causes less tool deflection, which minimizes vibration. When a shop applies ballnose cutters, toolmakers recommend that the contact point be moved from the cutter's tip, which isn't spinning. By tilting the tool, the workpiece can be engaged by a desired cutter area, which not only improves surface finish and repeatability but also extends tool life.

On a 3-axis machine, some parts are impossible to produce while others require too many setups to be profitable. Once your shop gets comfortable with indexing work, you can start machining parts using simultaneous multi-axis motions and open your business to new possibilities.

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About the Author:

Karlo Apro is senior applications engineer for CNC Software Inc., Tolland, Conn., and author of the book "Secrets of 5-Axis Machining," published by Industrial Press Inc., New York. For more information about the company's Mastercam CAD/CAM software, visit www.mastercam.com, call (800) 228-2877 or enter #360 on the Information Services Card.



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