Machining

The Top 5 Reasons to Adopt 5-Axis Machining

Don Sears | May 01, 2018

Are you on the fence about 5-axis CNC machines? Dive into the details of our infographic to discover how and why they open up a whole new world of manufacturing options and time-saving opportunities.

The throughput and accuracy that is possible on 5-axis machines are difficult to argue against. For those shops looking for new, profitable areas of work, these powerhouse machines offer precision combined with speed—and enable success for many of today's automotive, aerospace and medical-parts makers.

Do more machine axes automatically mean more parts will be built in less time? Not necessarily right out of the gate. Like anything that is new, expect a learning curve. Undoubtedly, there is more upfront simulation, testing and trial and error than you may be used to, so preparation and testing are key—as well as the need for machinists with strong programming aptitude and experience.

But with the right training and practice, it's hard to deny the productivity of these machines. Case in point: Sirris Manufacturing was tasked to help cut hefty 10-week lead times in the automotive industry for gearbox parts. The time-to-market for new cars and trucks is expected to move to 36 months from 48 months. Sirris cut lead times roughly 2700 percent by using an "alternating milling strategy in which first the left flanks and then the right flanks were machined," it notes ***in published research***. But due to pitch errors, it had to use a more nuanced tool-wear strategy to produce a quality part.

Sirris found greater accuracy and efficiencies using techniques available with the flexibility of a 5-axis machine. "[A]ctive compensation of the tool wear is required, which was only possible using a 5-axis strategy combined with a straight endmill. Combined with a tool cleaning operation, measuring and compensating after every flank allowed for the fabrication of a ground quality gear in 24 hours, which implies that instead of 10 weeks lead time, now only a few days are sufficient."

Here are the top reasons why 5-axis machines are so powerful.

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Machine performance matters. Here's how and why you need to rev up your 5-axis machines. It's time to level up to much faster spindle rpms at more complex cutting geometries—with easy setup. Get to higher quality finished parts in a fraction of the time.

1 Time Is Money: More Axes, More Parts

Why Do It
Save operating time by "shortening the process chain"

But Why, Really?
Cut parts on all sides as fast and accurate as possible

How
Tools and work piece can move up or down or side to side, tools can be precisely angled

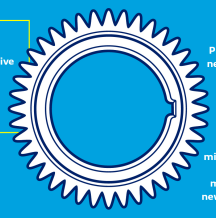
Types: Head/Table
The spindle head articulates the tool with tilting motions

Table/Table:
The primary rotary table carries the secondary rotary table which carries the fixture and the part

Head/Head:
Multi-axis machines execute all rotary/pivoting motions by articulating the spindle head of the machine

2 Drastically Cut Lead Time

Auto Industry Example
Highly-competitive time to market needs drive manufacturing improvements



How
Precision milling, new flanking and tool-wear compensation strategies

How else?
Straight end mill, tool cleaning, ensure flanks machined with a new tool are never near flanks machined with a worn tool

Part
Prototype gearbox

With Conventional Methods
10 weeks

With 5-Axis Milling
Less than 24 Hours

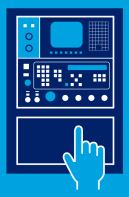
Who:
Sirris World Class Manufacturing

3 Do One Setup and Go: Automation Saves Time

Outcome
More accurate cutting, smoother finishing, faster cutting speeds, faster part making

Needed
Solid carbide cutting tools, work and tool holding, clamping

What
5-axis machines can hold many different tools at once



How
Designed to allow for precise tool axis and tip control, stock recognition, post processing

Key to Success
CAM simulation, testing and programming, balanced work and tool holding

Take Note
Programming is complex and takes time, but the productivity gains outweigh the effort

4 Reduce Cost Per Part

Outcome
Less setup time, higher speeds, more accuracy and better surface finishes

5-Axis Machines
Less time needed with "3+2" machining or simultaneous 5-axis

3-Axis Machines
Can only work on one side of the part at a time

3-Axis Machines Need
Recalibration, reprogramming

Outcome
More production time and labor

5 To Take Advantage of 3+2 Machining

Outcome
Good surface finish and accurate dimensions

Why 3+2
Allows for shorter, more rigid tooling, less programming and setups

Good For
Deep cavity molds, curved or angled tubes, cylinder head ports, valve ducts

How
Spindle head lowered close to workpiece

SOURCES: "High-speed 5-axis Machining for Tooling Applications" South African Journal of Industrial Engineering; www.scielo.org.za; "Lead Time Reduction by High Precision 5-axis Milling of a Prototype Gear"; https://ac.els-cdn.com; "An Overview Of 3 + 2 Machining" Modern Machine Shop; www.mmsonline.com

Spotlight on 5-Axis Machining

Here is a collection of the best articles on multiaxis-machine productivity and techniques, CAM/CAD systems and the future.

Optimize the Shop: Make the Move from 3-Axis to 5-Axis CNC Machining

What You Need to Know About Multiaxis CNC Machining

Learn How to Push Your 5-Axis Machine's Output

Video: Pushing CNC Machine Speeds to the Limit

Overcoming the Top Technical Challenges in Metalworking

How to Maximize Throughput and Part Quality When Threading

How to Plan for and Invest in a New CAD/CAM System

Tooling Matters: Boost Productivity By Saving One Second of Cycle Time

Ask an Expert: Georgia Tech Professor on the Future of Machining