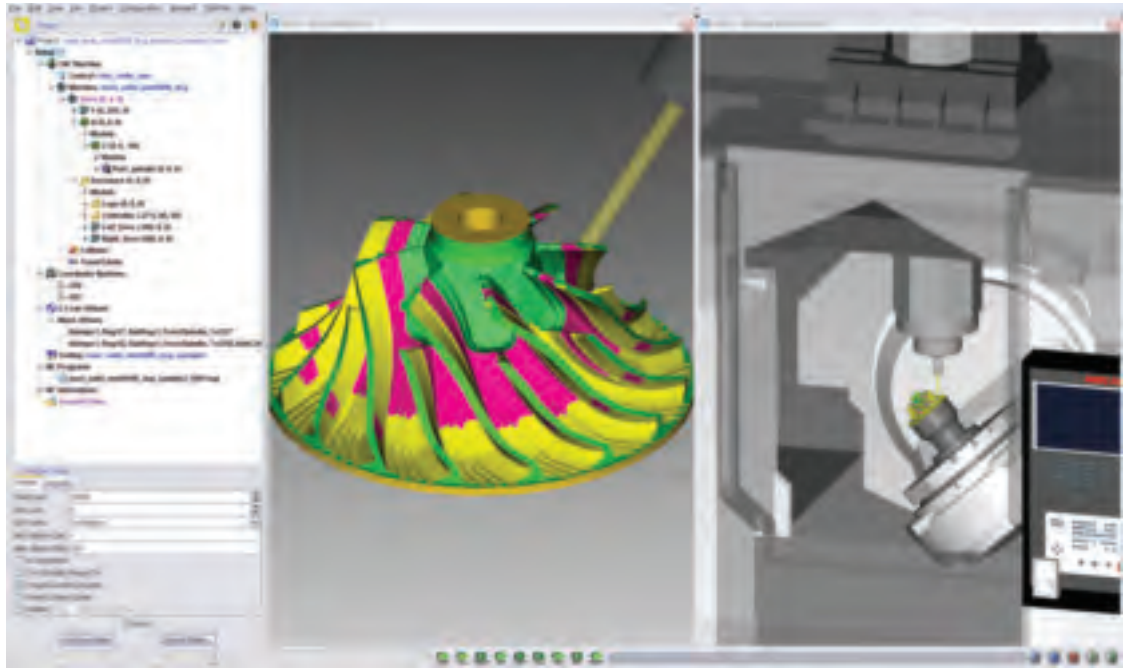


CGTech's VERICUT software performs 3-D simulation of an impeller being cut on a Mori Seiki NMV 5000 5-axis vertical machining center.



All images: CGTech

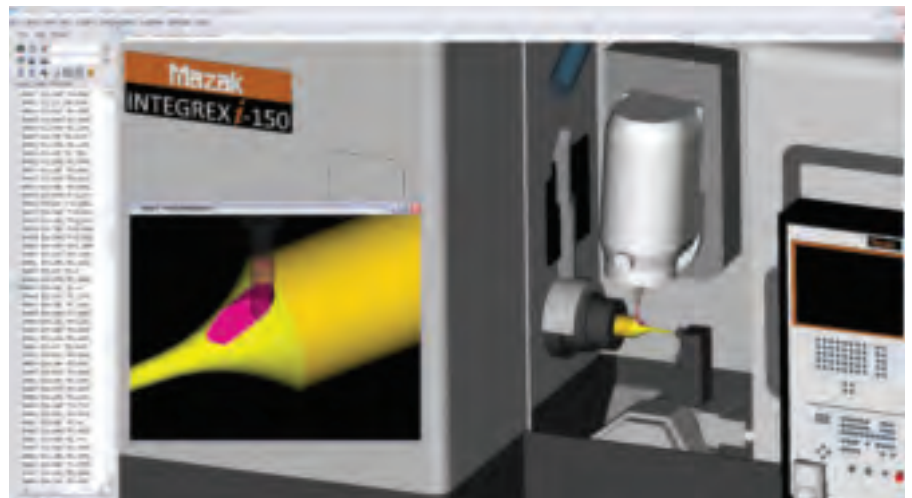
Eliminating surprises with simulation

By Bill Hasenjaeger, CGTech

As machine tool and part design complexity grows, part program verification using CNC machine simulation software has become an essential tool for ensuring NC programs machine the part correctly the first time. Skipping the verification step risks costly production delays where the machine tool waits while NC program errors are corrected.

VERICUT is a software program that interactively simulates and displays the material-removal process of an NC program. NC programmers use the software to verify the quality and accuracy of their NC programs while VERICUT's 3-D machine simulation checks for collisions. But the goal of simulation is not simply a collision-free and efficient NC program. The first and most important goal is verifying that a program produces the correct workpiece.

The simulation software's in-process model tells a programmer whether or not his program makes a correct part. For example, many NC programs incorporate circular interpolation. VERICUT emulates the circular motion and creates an as-machined cylindrical feature that can be



Simulation is performed on a Mazak Integrex *i-150* machine using CGTech's VERICUT software.

measured to ensure its correctness. This is in contrast to internal simulations that do not emulate circular motion, but instead divide that motion into a series of linear motions approximating the cylinder. These segments are not measurable as a cylinder.

The software's development is driven by evolutionary changes in manufacturing technology, including CAD/CAM software features, machines and tooling, machining techniques and processes, as

well as the need by manufacturers to implement and improve on these changes. The following trends and challenges produced ongoing manufacturing software enhancements.

More manufacturers need to simulate specialized machining processes and complex machines. When a specialized process reduces cycle time or increases reliability, more companies adopt it. By simulating these "special" processes early, VERICUT supports the next customers

to adopt them. For example, years ago it was rare to see an NC program utilizing now-common local part coordinate transformations and tool-axis vector programming. VERICUT supported these features when they were initially adopted, and others have benefited since.

Adoption of complex machine tools is a similar example. A few years ago, two-spindle, twin-turret mill/turn CNC machines were not common. Today, many manufacturers utilize multitask machines with multiple tool and part-mounting stations on various motion axes, all crammed into a relatively small space. The chance for collisions between machine components, tools and parts is high when several things move at once. Therefore, enhancements were added to the simulation software to support these machines during their introduction.

No one wants to spend time simulating a machining process, but it is a necessary step because of today's complex, fast-paced manufacturing environment.

The faster the simulation can return results, the better. Manufacturing software developers are constantly inventing, evaluating and implementing new algorithms to make simulation faster.

The latest VERICUT release includes new motion processing. "Motion simulation" refers to how the software calculates the motion path from the NC data and animates it. The software's simulation methods have been optimized to increase simulation speed, collision detection accuracy and animation consistency.

Mechanical designers strive to reduce the number of individual components in a product. For example, a trend in the aerospace industry is to replace sub-assemblies made of small components with large, monolithic structures. VERICUT makes it easier for programmers to view machining of the entire large piece while continuing to enable analysis of small local areas in fine detail without reworking or rerunning the simulation.

VERICUT's design is regularly re-

viewed and refreshed, focusing on how customers use the software and how it can better fit a modern manufacturing environment. In the latest release, the user interface has a more natural sequence to common user actions. Utilizing a top-down flow through a graphic tree layout, context-sensitive choices appear as the user moves along the NC program simulation process. As a result, setting up a new project and running a simulation is simple. Because the user's actions are acted on immediately, he sees the results. **CTE**

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