TOOLING

Incorporating Tool Manage

Bombardier Transportation implements integrated system to reduce costs, production time

A proper tool management system can save tool costs and shorten NC programming and positioning times provided the actual, real tool data is available to CAM programmers during the programming stage.

The Canadian-owned Bombardier Transportation plant in Netphen, Germany, produces body shells and bogies for rail vehicles. With more than 36,000 employees at 62 locations in 25 countries, Bombardier Transportation is the world's largest manufacturer of rail transport technology.

Between 2,500 and 3,000 carriage bodies and bogies are manufactured, painted, and assembled at the Netphen plant annually, and despite the economic downturn, order volumes have risen over the last few years to a point where the plant, with its workforce of 700, is now almost at full capacity.

The acquisition of new machines

Bombardier Transportation wanted a system to support its CAM programming work and also assist in the management of tooling inventory, storage, and ordering.

ment in CAM Programming

and tools wasn't all it took to handle the volume increase. The company also was forced to improve its productivity and reduce the relatively long periods of downtime caused by retooling its machines and loading new NC programs. To accomplish this, the company integrated TopSolid 3-D CAM software from Missler Software with a tool management system by Zoller.

Tool Setting Optimization

At the Bombardier plant, CAM programmers previously created NC programs for machining bogies using a 2.5-D programming system, which was time-consuming as well as prone to faults, explained Applications Specialist Michael Kringe.

> The database contains all the information required for machining purposes, saving time and minimizing the number of errors made when tools are being programmed.

"We programmed from 2-D drawings, which means that we never really knew what the chassis really looked like and if we had taken proper account of how to machine all of the interference edges," said Kringe.

Before the new installations, programmers were able to specify tools in advance only to a certain extent because they had no direct access to the tool data in a Microsoft Access® database. That meant additional work needed to be performed during tool setting. In many cases, it wasn't until the NC programs were being run for the first time that tools were found to be either slightly too short or too long, at which point further retooling was required.

In addition to the 3-D CAM system, applications specialists wanted an integrated tool management system that would enable them to access real tool data during the programming stage. However, the solution to their problem had to support their CAM programming work and also assist in the management of tooling inventory, storage, and ordering.

The company also wanted the new setup to be able to communicate with the measuring system.

An advantage of an integrated tool management system is that the company now has just a single source for all tool data—instead of having several databases—and thanks to the integration of the presetter, real measuring values can also be recorded.

An integrated tool management system enables access to real tool data during the CAM programming stage.

This is important for a number of reasons, the primary one being that some of the tools get reground, which means that diameters and lengths can vary slightly. The database contains all the information required for machining purposes, saving time and minimizing the number of errors made when tools are being programmed.

Programming With Integrated Tool Management

While the benefit of integrating a tool management system with the CAM software was a compelling factor in

deciding in favor of the Missler software, it was not the only reason.

Working together with Zoller, the Missler software team programmed the bidirectional interface between the CAM and tool management systems. The CAM programmers now type their desired characteristics and properties into TopSolid and gain direct access to the tool data in the tool management system.

According to Bombardier, this simplifies the work and also improves the reliability of the NC programs. However, for these tools to be able to simulate CAM programming, 3-D models are needed. These usually are created from the article characteristics as bounding geometry and made available to the CAM system. On complex contours, models also can be generated manually and stored in the tool database.

The system also has the ability to import 3-D models from manufacturers' catalogs in neutral formats.

The list of tools used for NC programming then can be given to the tool management team, which uses it to directly generate the setting sheets, something that reduces the work load associated with adjustment operations.

The Bombardier plant then incorporated the tool management system into its machinery. A particularly challenging aspect was finding a way to support the complex drilling/milling units from Bimatec Soraluce, equipped with tool-changing heads (indexing turrets).

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Depending on which surfaces of the chassis required machining, tools can be fitted in a fixed head, an angle head, or a pivot-orthogonal head. Because of this, the software is programmed in a virtual machine environment. The kinematics of the indexing turrets needs to be simulated reliably with their degrees of freedom and translated accurately into machine language.

Because Bombardier Transportation has standardized machining operations on its various sizes of drilling/milling units, only one post-processor is required. However, this required the simulation of machine-

An integrated presetter and tool management system saves time for Rüdiger Hof and Sergej Ponomarenko.

specific and also company-specific machining cycles.

For example, the company's CAM programmers use a subroutine technique that had to be made available within the new environment.

"Operations such as milling, line-by-line milling, or trimming can be set up just once as a subroutine that is then called up several times at different feed depths," explained CAM Programmer Damian Sakwerda. This delivers a number of advantages, the biggest one being that the NC programs can be relatively lean, making them faster to bring onstream and work with, added Sakwerda.

Reducing Positioning Time

The milling and drilling work involved on a complete welding frame can take up to 22 hours, depending on complexity level. It is therefore easy to picture just how much time is required to bring a completely new NC program onstream step by step.

Kringe estimates that these positioning times for the machining of a new workpiece have been cut by 50 percent. With the simulation functions in the CAM software, programmers are able to detect possible collisions while working at the computer, not the machine tool, which enhances the safety and reliability of operations. Further, the tool journey times to the machine from inventory can be simulated and optimized in respect of machine operating time.

Cost savings are achieved during the running-in stage largely because fewer programming errors are detected at the machine that require troubleshooting and remedial action.

The CAM/tool management integration also makes it possible to cut the time required to tool up and retool a machine because the tool management system knows which tools are already available on each machine. In practice, this means that it no longer takes four or five hours to implement machining of a defined workpiece on a different machine; that time is now cut to between two and three hours.

"Thanks to 3-D programming and integrated tool management, we have become substantially more productive in our machining operations," said Sakwerda.

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