SPRING Technologies: Streamlining the CAM-Room Process

CIMdata Commentary

Key takeaways:

- *The flexibility manufacturers need to achieve rapid switching of scheduled production from one CNC machine to another is severely limited by today's digital manufacturing end-to-end CAM-room process*
- *SPRING's NCSIMUL CAM solution is a key enabler for a new approach to digital manufacturing's end-to-end CAM-room process, and SPRING is making investments to expand their product portfolio to address this important need*
- *SPRING is positioning itself beyond offering only NC program verification and simulation to providing native G-code CAM programming, which is self-verifying, self-optimizing, and requires no post-processor*

The aerospace and defense (A&D) industry sector provides a growth engine for the economies of many countries. For example, research by Deloitte reports that in 2013 the worldwide A&D sector recognized revenue of US$706 billion and employed more than two million people.

The A&D industry relies heavily on machined components. For the A&D original equipment manufacturers (OEMs) and their suppliers, CNC machines provide a level of flexibility that facilitates rapid low-cost switching from producing one product line to another.

Many manufacturers of such goods increasing rely on product lifecycle management (PLM) strategies and enabling solutions to improve their manufacturing processes. SPRING Technologies is a leading provider of such solutions, and has recently expanded their support of PLM by introducing a new organically-developed solution that has been designed to streamline the entire end-to-end CAM-room process, and has the potential to dramatically increase the scheduling flexibility for manufacturers who use CNC machines.

Introduction

Manufacturers strive to remove both cost and time from their manufacturing processes, while at the same time seeking to continuously improve the quality of their manufactured parts. They are challenged daily in doing so, attempting to arrive at the ideal match between available production resources and the ever-changing production demands of their customers.

Manufacturers who have chosen to use CNC machines because of the flexibility they provide in facilitating rapid low cost switching from one product line to another find that the very flexibility they had hoped to achieve is limited by today's digital manufacturing end-to-end CAM-room process.

SPRING has a vision to change the end-to-end CAM-room process through its new product NCSIMUL CAM, and is investing heavily in doing so.

The Three-Decade-Old CAM-Room Process

Bringing a manufactured product to market begins with a market requirements specification that product engineering uses to produce a preliminary design, and through collaboration with manufacturing engineering, the preliminary design is refined into a final design.

If CNC machines are to be used in the manufacturing process, NC programs must be created, and this is where the CAM-room process begins. The objective of the CAM-room process is to produce NC programs that assure optimum run-time performance, and that also have been verified to be free of unintended collisions that have the potential to scrape a part, or damage the machine, tooling, or fixtures.

There are four main steps in the CAM-room process. In the first step, a CAM system is used to create toolpaths based upon 3D CAD data that represents a machined part or tooling component. Toolpaths describe a series of milling or turning CNC machine operations using various cutting tools.

The second step of the CAM-room process is to use a software post-processor to change the CAM system's proprietary toolpath into an NC program in the G-code format. In most cases, the toolpaths created by a CAM system are maintained within the CAM system in a proprietary format. Generally, CAM systems output their toolpaths in a generic format, such as CL-file or APT file formats. Most CNC machine controllers use the G-code format to move the machine to various points at a desired speed, to control the rotational speed of the spindle, to turn on and off coolant, and to manage a variety of other conditions.

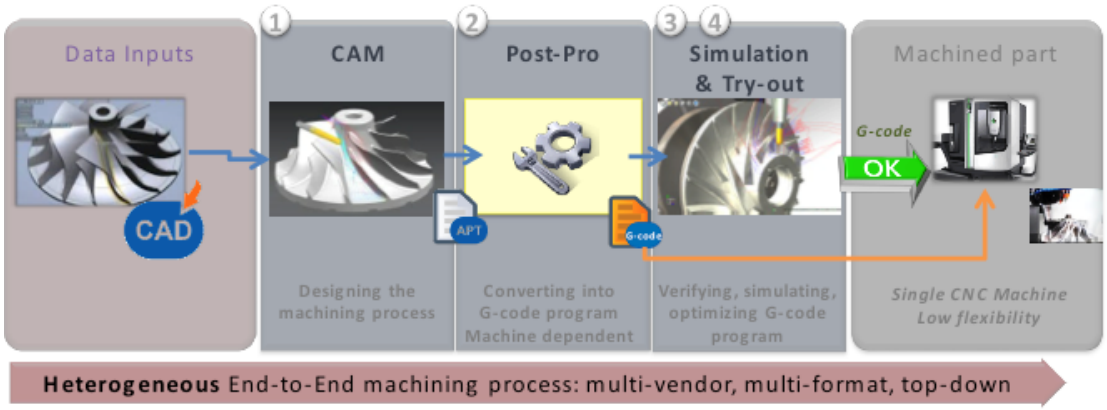

Figure 1—Three-Decade-Old CAM Room Process

In the third step of the CAM-room process, the programmer may choose to use software to optimize the NC program's actual machine run-time performance. The optimization software analyzes the NC program and makes feed rate adjustments based on specific path-monitoring optimizing strategies.

As the fourth and final step in the CAM-room process, try-out is performed to de-risk the NC program and verify it for production. Many years ago try-out was performed on an actual machine, but for the past twenty years or so try-out could be performed virtually through a computerized verification and simulation process. After try-out, technical documentation is created to communicate machine and tool set-up information to the shop floor.

If problems are encountered in any step of the CAM-room process, the NC programmer must return to the CAM system to make corrections. After corrections are made in the CAM system, each subsequent step must be repeated, as the entire CAM-room process is a one-way process. It is nearly impossible to predict the amount of time it will take to iterate through

the CAM-room process before a toolpath can be declared to be verified and ready-to-use for production.

When switching production from one CNC machine to another, most of the CAM-room process must be repeated to produce a verified and ready-to-use NC program for the new target machine. It is the unpredictable time it might take to iterate through the CAM-room process that limits the rapid switching from one CNC machine to another.

SPRING currently produces solutions that support most of the CAM-room process, including solutions for post-processors; cutting tool management; NC verification, simulation, and optimization; technical publication; and machine status monitoring. SPRING has not previously provided a CAM solution for creating new toolpaths and related toolpath data.

Common Machining Production Challenges

The production side of manufacturing is challenged with scheduling, manufacturing, and shipping product. To increase asset utilization, production is continuously adjusting and aligning their available resources to the ever-changing daily demands of their customers.

Historically, the flexibility production needs to achieve rapid switching of scheduled production from one CNC machine to another is severely limited by the unpredictable time associated with the iterative CAM-room process as it could take several days to adapt a CAM system's toolpaths to a new target machine.

Furthermore, many manufacturers have NC programs that are no longer defined within a CAM system, making it impossible to quickly switch production to a different CNC machine, and also making it difficult for them to take full advantage of investments in newer high-end technology available in the latest CNC machines and controllers.

Addressing Production Challenges Using NCSIMUL CAM

SPRING Technologies' vision is to change this situation with its new product, NCSIMUL CAM, providing native G-code programming that is self-verifying, self-optimizing, and requires no post-processor.

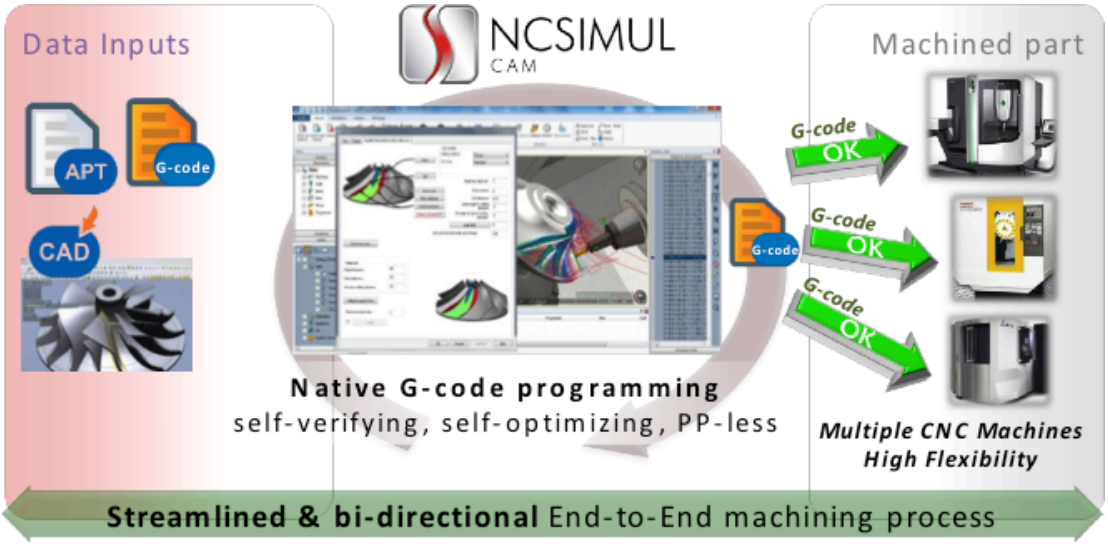

Figure 2—SPRING's Native G-code CAM Programming Vision

With NCSIMUL CAM, users are able to create toolpaths, verify toolpaths, and change machines at will, generating the intended G-code based NC program "on the fly." NCSIMUL CAM does not require its cutter paths to pass through the one-way CAM-room process before being verified as suitable for use on the shop floor.

Rapid switching of machines, fixtures, and tooling will be achieved by changing appropriate parameters in NCSIMUL CAM, automatically producing a verified and optimized NC program for the new configuration. This is all done without the need to re-create any single cutter path, and without the need to pass through today's digital manufacturing end-to-end CAM-room process.

Furthermore, NCSIMUL CAM provides hybrid toolpath programming, allowing users to import any existing G-code NC programs as well as APT or CL-data files from any other CAM system process, allowing one-click reprogramming when switching machines. Additionally, users are able to revise or add machining operations as well as reorganize operations to reengineer a new machining process.

NCSIMUL CAM operates within the same framework and the same GUI as SPRING Technologies' flagship product, NCSIMUL Machine. SPRING Technologies lists five key differentiators with existing CAM systems:

- Native G-code Programming—when a user creates a toolpath with NCSIMUL CAM, the software produces a fully optimized and collision-free G-code NC program for a target CNC machine, without additional user-operations.
- No Post-Processing—since all tool motion is calculated by NCSIMUL CAM's new G-code based processor technology, using the target machine's CNC machine logic, no post-processing is required.
- Hybrid Programming—allows existing G-code NC programs and APT/CL-data files to be imported so new toolpaths can be added and operations reorganized.
- One-Click Re-programming—when the machine, fixtures, or tooling (including cutting conditions) change, NCSIMUL CAM will automatically produce a fully optimized and collision-free G-code NC program.
- Dynamic Rest Model Management (DRRM)—toolpaths can be calculated based upon the stock remaining from all prior toolpaths. Changing parameters for any toolpath results in a recalculation of subsequent paths.

Roadmap for Development

Following the planned announcement in June 2015, SPRING Technologies plans to release all of its modules under NCSIMUL SOLUTIONS V10, which include NCSIMUL modules CAM, TOOL, MACHINE, and PUBLISHER.

The NCSIMUL CAM V10 release will provide 2- to 5-axis drilling strategies, import of APT/G-code Milling/Turn, and other features to support milling and drilling machining strategies. The NCSIMUL CAM architecture is based upon well-proven technology, to include a Parasolid-based 3D modeler and native CAD interfaces to a variety of commercial CAD offerings.

NCSIMUL CAM's programming strategies are to be both internally developed and licensed from CAM component providers. SPRING Technologies plans to provide additional functionality in annual software updates.

Go to Market Plan

SPRING Technologies plans to provide NCSIMUL CAM to select existing customers and to further develop its functionality based on their requirements and needs. They expect to establish strong reference accounts from within this group before taking the product to the broader market.

SPRING Technologies and CIMdata believe the relationship with existing customers will provide the ideal environment in which to refine and further develop a solid and reliable product. Many SPRING Technologies customers have a growing need to be more flexible in matching their available production resources to the ever-changing production demands of their customers. As most SPRING Technologies customers are already using CAM systems, SPRING Technologies expects NCSIMUL CAM to be used primarily as a complementary solution to existing CAM systems as a means to enable rapid switching of scheduled production from one CNC machine to another.

Many of these customers also have a collection of NC programs that are no longer supported by a CAD/CAM system, and can only be used on a single existing machine, causing older machines to be retained beyond their preferred life span. With NCSIMUL CAM, users will be able to import these unsupported NC programs, providing the customer a means to either switch production to a different machine or replace their oldest CNC machinery with newer technology.

Conclusion

SPRING Technologies' vision for native G-code cutter path programming is an ambitious undertaking. The CAM market is already overcrowded, as evidenced by the fact that after years of resistance, the CAM market has seen significant consolidation. Bringing a new CAM system to market overcrowded with contenders, and within an industry that is consolidating, may encounter limited demand. However, CIMdata believes there is a clear market need to increase the scheduling flexibility for manufacturers who use CNC machines and who must continuously re-align their resource allocations to meet changing customer demands. Addressing this need is a challenge for the current CAM-room process and CIMdata views SPRING Technologies' G-code CAM solution as a potential solution.

While competitors may be able to respond with their own versions of a native G-code toolpath programming solutions, SPRING Technologies has a level of expertise and experience in much of the CAM-room process that is required to deliver on the vision. These capabilities may not exist in competitor organizations. SPRING Technologies' performance to date is quite impressive and CIMdata looks forward to seeing how the market responds to this new innovative offering.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at http://www.CIMdata.com or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48108, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.