Vericut

CPM Manifold

User Story

To optimise their hydraulic block design, CPM Manifold uses CGTech's VERICUT simulation software. VERICUT's main benefit is the ability to equip the machine with stock and tools, load the NC program, and start unattended machining while being certain that the process will perform as designed and without any collisions.

The hydraulic block is a critical part of hydraulically operated machines because it controls the quantity of fluid flowing being machine components. Creating a hydraulic block takes craft, experience, and knowledge of the most innovative technologies to design and produce a part that complies with the highest quality standards. In Paitone, in the Brescia province, there is a company that has been machining components for over 50 years and specialises in the production of hydraulic blocks. This is CPM Manifold, a family-run company where production processes are certified and quality is essential.

"We have always been very quality-focused across the board, from the NC program to the finished product," says Andrea Tofanelli, Quality Assurance at CPM Manifold. "We currently have the ISO 9001:2015 certification for quality management systems. More and more companies, especially those who represent our target customers, require this certification; it would be nearly impossible to export our product without it. In the future, we're aiming to acquire other certifications to further expand our customer portfolio. Hydraulic blocks are used in different industries such as the industrial sector with mould and die machines, the steel and wind power sector, and more generally in energy, naval, automotive[...] Really, our blocks can be used wherever there are hydraulic engines and systems. We are currently the leader in Italy and among the main producers in Europe. Our products are intended for large, multi-national companies."

Hydraulic Blocks that Reach 20 Tons

The hydraulic blocks created by CPM Manifold are unique, Andrea Tofanelli explains. "Our blocks contain decades of experience in this industry, where each cavity is created using cutting-edge tools to ensure that our blocks are of the highest quality. We are renowned, above all, for the production of large protypes - our 'record' is a nearly 20-ton block - but we have also been moving toward series production.

Since knowledge is important for successful manufacturing and NC programming, CPM Manifold conducts most of the processes internally with a staff of 70 people. They rely on external suppliers to perform only some surface finish treatments.

Inside the workshop with about 15 machining centers, Andrea Tofanelli says that the machines and processes are in line with the philosophy of Industry 4.0. "With some help from other companies, we have also been developing

software for 360-degree supervision of everything around the production of the blocks. For us, machining efficiency is fundamental and the data that comes to us from production undergoes almost daily analysis."

Close Customer Collaboration Leads to Co-Design

The design processes are carried out internally, with 7 people who work in the CPM Manifold technical office. "When a request comes from a customer, we design a block from scratch based on the hydraulic diagram they give us. In the technical office, we have a person whose sole role is to create the block from the diagram. We collaborate heavily with our client companies, which almost goes as far as co-designing. We put our manufacturing experience at their disposal and we maintain constant communication to meet every design requirement."

Besides design, simulation is also important, which was why CPM Manifold adopted VERICUT a few years ago and found immediate benefits, Andrea Tofanelli recalls. "The choice to install CGTech software in the company goes back about 3 years, and the implementation of VERICUT was my first job within the company. We pay attention to quality through every business process. In order to provide the workshop with a high-quality machine program, we decided to adopt a simulation software that allows us to resolve critical issues in the program directly in the technical office.

"VERICUT's main benefit is the ability to equip the machine with stock and tools, load the NC program, and start unattended machining while being certain that the process will perform as designed and without any collisions. When we produce multiple prototypes, including those that weigh several tons, this is a huge help. Another benefit is the ability to continuously improve the program directly from the technical office, allowing us to test more efficient macros in simulation without risk of damaging the machine or tools."

VERICUT Rationalises and Standardises Programming and Tooling

Andrea Tofanelli could cite several examples to show how VERICUT has solved real problems. Among the main benefits, he recalls the issues found on 5-axis machines. "With VERICUT, the program is tested directly in the technical office and we communicate with the shop floor about how to assemble to tools to ensure there are no collisions during the complex, simultaneous movements across the 5 axes. Another benefit of using VERICUT is the ability to design equipment by simulating its dimensions before we start machining them."

"Adopting VERICUT has 'forced' us to rationalise and standardise the programming and tooling process of our machine tools, which is a fundamental part of improving processes. When I think about companies subject to high

turnover and a lack of specialised operators, VERICUT simulation helps to fill in any gaps in the workshop. I think that the companies that would benefit most from VERICUT are those that deal with creating new programs daily. Wherever we have an NC program, simulation is always a great option. For us, [simulation] has become an indispensable part of the production process."

Avoid Machine Collisions and Problems with Travel Limits

CGTech is based in California with an office in Treviso. VERICUT makes it possible to identify collisions, errors in the NC program, and inefficient machining. The software allows users to recreate a virtual machining center and simulate post-processed NC programs or those created manually on the machine. The stock material that is virtually machined is a parametric solid model, meaning that at any time during the simulation, users can stop and analyse the program block by block, measuring the piece and comparing it with the designed model. VERICUT helps avoid machine collisions and travel limits, eliminates prove-outs, reduces machining times, and certifies NC programs for the shop.

Analyse and Optimise Cutting Conditions

The most recent release, VERICUT 9.2, and the Force optimisation module are the result of CGTech's focus on new technologies and processes, the evolution of materials, the needs of their customers and partners, and the urgent requests for sustainable manufacturing. Force optimisation allows users to discover less tangible aspects of machining inefficiencies by analysing and optimising the cutting conditions during the cutting process for both milling and turning. Force calculates new feed rates while maintaining a constant, ideal chip thickness and limiting excess cutting forces or spindle power.

Optimising with Force means finding the best feed rates based on the physical properties of the stock and cutting tool, the tool geometry including overhang, number of teeth, rake angles, and part geometry. Force has a constantly updated catalog of materials characterised by dynamometric tests. The graphs that result from the simulation represent force, chip thickness and removal rate, power, and tool deflection for each tool used in the program. Force also allows users to compare the original NC program with the optimised one. The optimisation changes the feed rate and spindle speed of the original program, breaking up program blocks where necessary and assigning the calculated feeds and speeds to each block, all without altering the tool path.

Optimisation results are seen in shorter machining times, longer tool life, and better performance of the machine tool itself. The machined components present a higher quality surface finish and boast an overall saving in time and costs with more efficient machining. VERICUT can be applied to all manufacturing industries such as aerospace, energy, automotive, medical, and more by simulating

all types of machine tools (machining centers, lathes, lathe-milling, robots, etc.). VERICUT is an independent software that can interface directly with CAD/CAM and tool management systems for all the benefits of an integrated work environment. CGTech also develops composites-focused software to program CNC machines with AFP (automated fiber placement) and ATL (automated tape laying) technology, additive and hybrid CNC machines, as well as drilling and fastening.

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