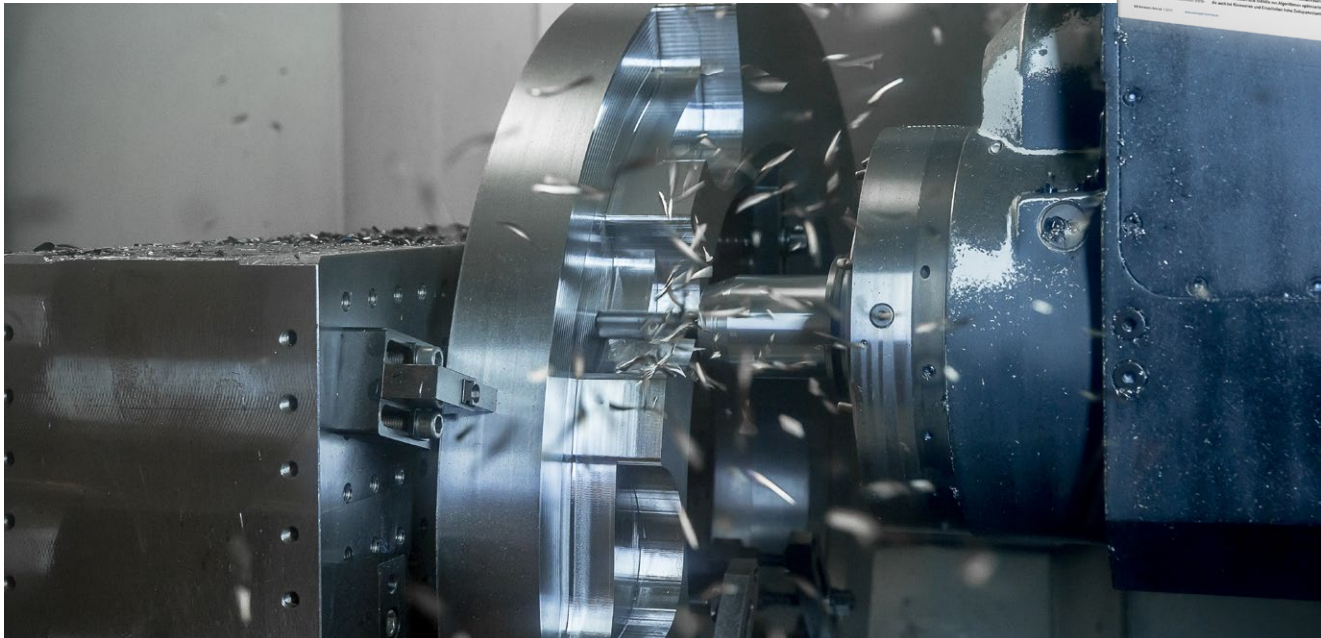


Ultra-efficient programming for complex parts

Fast CAM programming, optimum metal-removal rate with high process reliability and tool service lives that are many times longer. SolidCAM and iMachining can deliver all this reliably, say users from several different areas of metal machining.

by Leif Knittel



In high-performance roughing processes such as full-slot, plunge, and trochoidal milling, optimized tool paths can be calculated using algorithms, enabling high metal removal rates to be achieved even with small batches and single pieces (photo: Leif Knittel)

The economy is ticking along nicely. The order books are full. Many manufacturing companies are seriously considering expanding capacity. Long delivery times for machine tools are just one of the reasons CEOs and business owners wish they had a crystal ball: What's most likely to happen first? The much-needed machining center, an application for the current vacancy of CNC programmer, or might that even be the next crisis looming on the horizon? Although one option would be simply to sit on your hands and wait, mounting a proactive search for higher efficiency

and a way to unjam bottlenecks is surely the better alternative.

Optimized roughing holds the key to higher productivity

It is patently clear that every individual manufacturer has completely different requirements when it comes to their value chain and their internal workflows. However, all companies that machine metal can benefit equally from the latest trend in CAD/CAM, cutting technology, and tools. For a long time, increased productivity in metal machining mainly boosted the coffers of the machine tool

and control system manufacturers. Faster controllers, dynamic machine designs, high-performance spindles, and ultra-fast tool changeovers have enabled faster machining and optimized idle times. As far as milling tools and the actual cutting process were concerned, however, progress was sluggish for a long time.

At the same time, machining technicians are battling increasingly tough requirements. There is a trend toward ever more complex part designs and complete machining from solid blanks on multiple axes,

where optimizing roughing is one of the ways to unlock higher machine productivity. Common strategies for high-performance roughing have so far included full-slot milling, plunge milling, and trochoidal milling.

In practice, however, there are some major disadvantages in addition to the theoretical savings. In the past, for instance, none of these technologies proved completely convincing in terms of process reliability, tool costs, and spindle and machine wear. What is more, the time and effort required for CAM processing and for fiddling about to find the best cutting parameters were simply too great when producing smaller batches or even individual pieces.

iMachining

iMachining technology for 2D and 3D machining is an integral part of the CAM solution SolidCAM. As a complete solution, SolidCAM can be seamlessly integrated in the SolidWorks and Autodesk Inventor CAD systems. iMachining is also available as an add-on for Siemens NX. Based in Schramberg, SolidCAM GmbH has six sites in Germany and over 60 employees working in technology, support, and sales.

The only way to achieve major productivity gains is to have an innovation that boosts several links in the value chain at the same time.

If you believe machining technicians, customers, and other users who machine with SolidCAM's iMachining technology, then the patented software module is here to stay.

Machining areas allocated intelligently

Devising algorithms to generate tool paths is no easy task. After all, it is no secret that most CAM systems now use licensed software modules from specialist providers to actually calculate tool paths. These modules are then "fed" the necessary parameters when the user enters data. The art in all this lies in creating and designing the user interface, which helps the user set the geometries to be machined and retrieves all the relevant parameters for calculating tool paths. Behind the catchy names of all the various CAM modules currently available for high-performance roughing lies an identical software library in virtually all cases.

By contrast, the technology behind iMachining has been developed entirely by SolidCAM. Instead of creating trochoidal tool paths, the iMachining algorithm generates dynamic, adaptive D-shaped and spiral paths. The software divides machining areas up intelligently so as to minimize unproductive empty paths and "air cuts." To keep cycle times as short as possible, the routes between the individual steps are traversed in rapid mode. The average chip thickness is always used as the starting value

when calculating feed rates in order to optimize cutting and extend tool service life. To keep this measurement constant whenever the tool is in operation, the actual feed rate at every position along the tool path is calculated and fine-tuned.

The so-called iMachining Technology Wizard is just as important as calculating and allocating efficient tool paths. This patented software wizard uses the specific characteristics of the materials stored in the module to optimize all of the machining parameters. The user only needs to enter the tool type, the geometry, the material to be machined, and the name of the machine in order to set up a roughing run. The Technology Wizard calculates the maximum milling speed and force based on the machine's performance data. The user can control the aggressiveness of the cutting on a sliding scale on the iMachining user interface known as the Level Slider, which has levels numbered 1 to 8 as well as a Turbo mode. The iMachining level can be used to individually set the machining speed to the clamping situation and the general state of the machine.

Process reliability ensured for the manufacture of high-precision medical parts

The iMachining module is now an essential tool in medtech manufacturing and the aerospace industry. Alongside the industry giants, medtech customers also include many suppliers who have gained a major competitive edge in titanium or stainless steel milling thanks to iMachining.

Christian Truckenbrod, Head of CAM at Michael Strub, a manufacturer of surgical instruments based in Neuhausen ob Eck, swears by the process reliability that iMachining brings. Strub's portfolio includes ultra-precise, ultra-small parts that are milled from solid blanks with tools up to 0.4 mm (0.02 in) in diameter. "Uncontrolled tool breakages are one of the biggest problems in fully automated, robotized manufacturing. Ever since we started working with iMachining, our parts have been processed reliably," says a happy Truckenbrod. In particular, he explains, SolidCAM enables complex



For surgical instrument manufacturer Michael Strub, iMachining technology enables the fully automatic machining of difficult materials using small tools and with full process reliability (photo: Leif Knittel)



At EDM Aerotec in Geisleden, Thuringia, the individual components of the ultra-lightweight CoAX 2D helicopter are programmed and manufactured using SolidCAM and iMachining (photo: Leif Knittel)

multi-sided machining for three- to five-axis machining centers to be programmed quickly. He also says how easy it is to create any number of zero points on the workpiece and then use these as a basis to set up individual milling and drilling activities. Allocating the remaining material to the various zero points and instigating the necessary swiveling operations on the machine are done fully automatically by SolidCAM, Truckenbrod adds.

No risk of high cutting values right from the very first workpiece

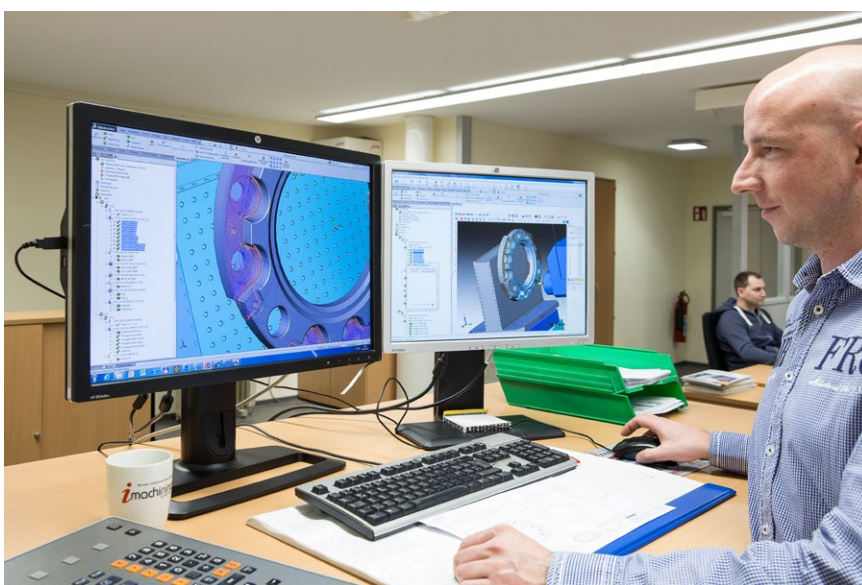
Based in the Thuringian town of Geisleden, EDM Aerotec GmbH

develops and manufactures CoAX, the only airworthy ultra-lightweight helicopter of its kind in the world.

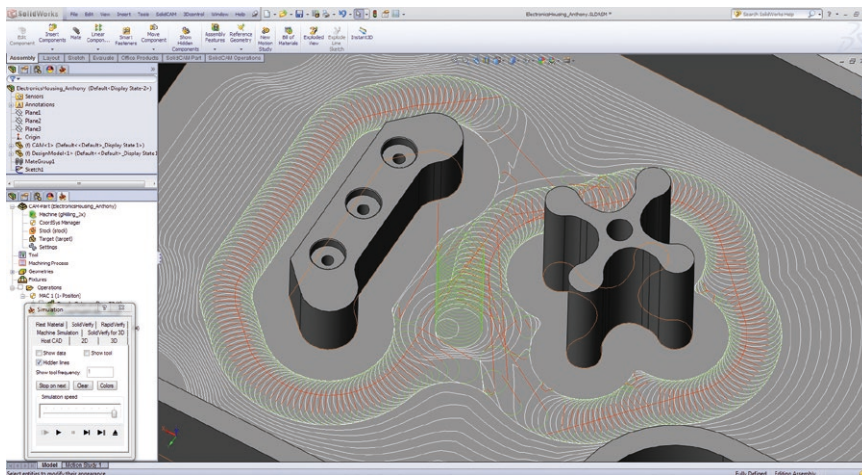
As Head of Design Markus Gebhardt admits, the project would never have got off the ground had it not been for iMachining. The high-strength materials that have to be used to make the aeronautical components such as the CoAX's rotor mast could not have been machined economically without iMachining as the tool costs and the time required for CNC programming would have been too great given that quantities were still small. Thanks to iMachining's Technology Wizard, says Gebhardt, his CAM programmers can

be completely confident of getting the most out of the machine right from their very first workpiece. Gebhardt has been working with SolidCAM since as far back as 1996. He recounts his first experiments with iMachining: His machine operators had taken one look at the high transverse and vertical feed rates and had almost refused to start the machine up. This initial fear soon turned to enthusiasm, however, as his team quickly familiarized themselves with the new technology.

It was a similar story at Liebherr, based in Nenzing, a town in the Austrian province of Vorarlberg. The company uses 18 machining centers to make components for crawler cranes and specialist civil engineering machinery that can be up to 6 m (19.7 ft) long. The initial tests with iMachining turned out to be an absolute key experience, remembers Head of Production Michael Torghele with excitement, because the service life of the tools virtually went through the roof. They are likely to have been the first SolidCAM users in the world to use iMachining in heavy machining with porcupine mills instead of VHM mills.



SolidCAM and iMachining have allowed Liebherr's Nenzing plant to boost productivity by at least 30 percent and cut tool costs by over half (photo: Leif Knittel)



One of the benefits of the CAM solution: intelligently allocated work areas reduces empty paths and keeps cycles short (photo: SolidCAM)

Heavy machining using porcupine rather than solid carbide mills

Michael Torghele emphasizes that the massive increase in tool service life brought about by iMachining was much more important than the impressive reduction in the production time per piece. He reports that the consistent cutting depth means that the machines now work much more quietly and that problems caused by faulty spindles and bearings in heavy machining have been eliminated. Thanks to optimum tool paths, the service life of the machines has been significantly increased. Efficient CNC programming with

SolidCAM coupled with lower tool costs and shorter processing times have now made internal production at Liebherr 20 to 30 percent more economical than the extended workbench, he says.

As Christian Huber, a CNC programmer at Liebherr, explains, iMachining brings an additional “soft” benefit in addition to the tangible increase in productivity: “We no longer have to guess which feed rates, speeds, and step-ups should be used for which material and tool. iMachining takes this uncertainty and responsibility completely off our shoulders. This is extremely motivating.”

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