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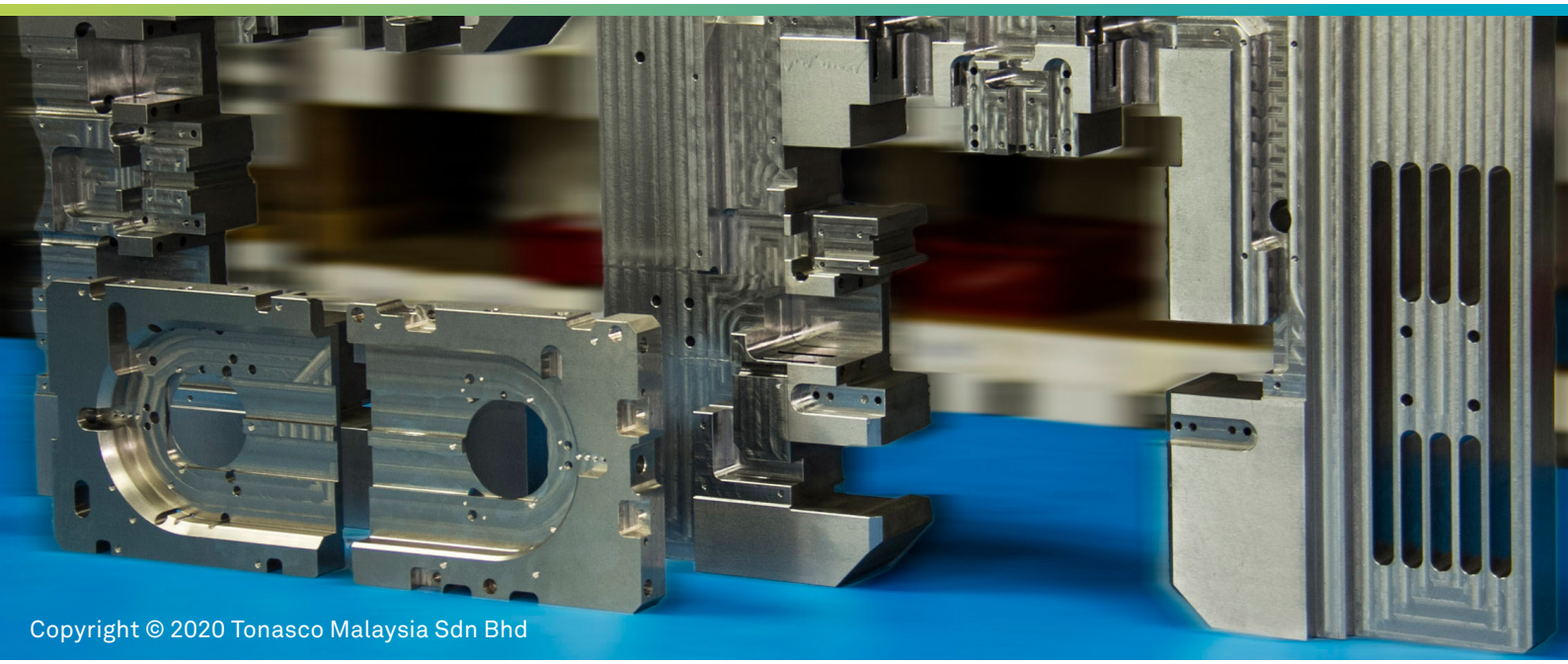
Case study

Precision in every single piece with NCSIMUL



Tonasco Case Study

Founded in 2006, Tonasco started with exporting high-precision machined components from Malaysia to the Netherlands. Their founders, Moors & Lin, were inspired by the export potential of high-quality machined components made in Malaysia, and found a niche in high-precision mechatronics components.

For over 10 years, Tonasco has established themselves as a specialist precision-components contract manufacturer. Tonasco's expertise in producing a mixture of precision components in single quantities at low costs has given them a unique competitive advantage, hence their motto, "Precision in Every Single Piece".

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>
> **Toon Moors,**
> Technical Director

To date, Tonasco has gained a strong EU-based clientele of over 120 customers in the Netherlands, Germany, Belgium, Italy, France, and Switzerland. Many of their clients are market leaders in specialised domains of production-automation technology for the automotive, semiconductor, medical, and analytical instrument sectors.

To stay on top as a preferred manufacturing partner for their customers, they have continuously initiated process improvements and automated production processes.

Tonasco's strong emphasis on quality control helps them achieve high yields with consistent quality. The company measures all of its parts, which equates to the inspection of between 400 and 600 parts weekly.

The company has a large quality control department equipped to measure precision tolerances up to +/-0.002 mm. Their extensive list of measuring equipment includes 3D coordinate measuring machines (CMM), video measuring systems, digital height gauges, and more.Every part measured is delivered to the customer with a quality-control report.

Continuous investment and improvement in Tonasco quality-control methods and policies ensure that they can deliver quality parts and modules that meet their customers' ever more demanding standards.

To continue to remain competitive, in 2019 Tonasco began looking for new ways to improve productivity in their workshops and bring more flexibility to their manufacturing processes. Specifically, they were looking for the ability to:

- Verify and simulate CNC programs offline
- Optimize existing NC programs to reduce cycle time and improve tool life while maintaining surface quality

"From handling hundreds of single-piece drawings per day to producing hundreds of different machined parts, the key to our successful single-piece fabrication is well-designed processes executed with diligence and consistency," said Technical Director Toon Moors of Tonasco.

"There is a high degree of standardisation in our operating processes, from production planning to programming and machine operation. As a result, complex production workflow comprising multiple setups of workpieces and cutting tools can be performed efficiently with minimal errors, optimising production time."

NCSIMUL is the best solution for helping Tonasco reach its objectives and meet the challenge of constantly developing new capabilities to meet evolving customer requests. As NCSIMUL is taught to students who will eventually work in the manufacturing industry, Tonasco's implementation of the software has helped them to secure the best industry talent. It's also helped them to embrace new technologies, exceed industry standards, and establish best practices that support Industry 4.0 and sustainable manufacturing.

The introduction of NCSIMUL Machine verification and simulation:

To carry out production for its OEM customers, Tonasco invested in three, four, and most recently 5-axis technologies to meet production ramp-up and the ever-increasing complexities of customer parts.

The parts that Tonasco manufactures are 80 percent milled parts with up to 5-micron tolerances on efficient and sophisticated CNC machine tools, such as those made by Okuma, DMG, Makino, and TAKISAWA, to name a few.

At Tonasco, all programming activities are performed by a team strong of five programmers who use the OPEN MIND CAD/CAM system, by hyperMILL®, to create 3D parts, 3D drawings of fixtures and clamps, rough stock, final CAD parts, and CNC programs.

"In the past, we were testing the output of our post-processors directly on the real machines with machining on a model made of resin, foam, wood, etc., then a real part using the 'block by block' method, or directly machining the real part at reduced speeds," said Moors.

It was clear that, if a problem occurred, immediate action had to be taken to modify the program, thereby causing the machine and operator to become idle while this was done. During these tests, NC programmers and operators feared tool and machinery breakage.

“The breakage of equipment or machinery of course generates the cost of sometimes extensive repairs, but can also be a source of risk for personnel. Everything should therefore be done to eliminate it,” Moors said.

“After benchmarking solutions available on the market, we decided to acquire NCSIMUL Machine and were impressed by the speed, ease of use and three-step process that NCSIMUL Machine provides to our programmers to make sure that toolpaths run collision free and that the whole machine-tool environment and behaviour can be simulated just after the programming process. For us, the ability to avoid any issues justifies the adoption of NCSIMUL,” concluded Moors.

The “digital twin” in the NCSIMUL Machine environment:

A key element of Industry 4.0 is the creation of electronic “digital twin” models of product data and production processes. These virtual models correspond with the physical shop-floor processes and allow manufacturing operations to be simulated, tested and altered to avert possible problems and downtime while facilitating process optimization.

NCSIMUL Machine software works directly with ISO NC machining codes to simulate, verify and optimize machining programs based on specific parts, tooling, and real machine-tool characteristics.

The first job for the NCSIMUL team was to collect the data for each of Tonasco’s five CNC machines. NCSIMUL Machine-Tool builder 3D generates models to customize kinematics and develop digital twins using information from real CNC controllers (.arc for Siemens, .xxx for Fanuc, etc.) that match each controller’s capabilities, builder or

customer-specific macros, sub-programs, and loops for offline simulation.

With digital twins that perfectly match the behaviour and real output of CNC machines, Tonasco can trust what they see on screen and have started to use the acronym WYSIWYC, or “What You See Is What You Cut”. It is now a company rule that all programs go through the NCSIMUL three-step-process for verification and simulation before sending programs to the workshop. With the hyperMILL to NCSIMUL interface, all programming data is automatically and efficiently sent to NCSIMUL without any manual operation and loss of data, explained Moors.

As a result, Tonasco reduced their manual prove-out process time by up to 80 percent and dramatically reduced online setup, debugging and prove-out times for FA (First Articles) parts. NCSIMUL Machine verifies NC programs in three steps: first, it investigates and corrects coding errors; second, it simulates to locate collisions and correct motion errors; and, lastly, it validates NC programs. “We also use NCSIMUL as a training tool for new employees because the virtual sessions are short, easy to understand, and eliminate errors,” concluded Moors.

Three-step process for NCSIMUL Machine:

Analysis of the NC program

- ISO decoding supporting structured programs, variables, cycles, and macro calls with an unlimited choice of commercially available NC controllers
- Toolpath preview before simulation, rapid first-level analysis (incorrect program origin, etc.)
- Automatic detection of programming errors (ISO syntax, out-of-range motion, compensation errors, etc.)
- Integrated ISO program editor for on-line modification
- Precise and reliable estimations of cycle times

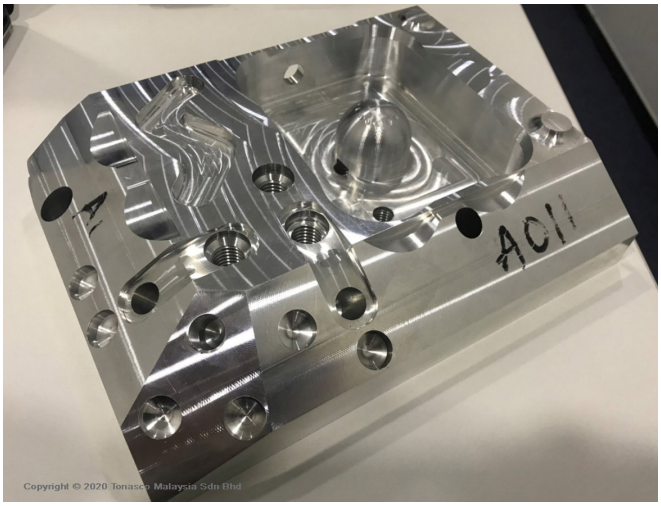
Material removal and machine simulation

- Material removal on a solid model for all types of machining
- Total simulation of the "machine-part pair" with detection of all collision types in a single process
- Detection of machining errors (rapid motion, spindle stopped, part marked, etc.)
- 3D viewing operations (rotate, zoom, pan) independent of program size, complexity of the part or program probing

Dimensional analysis

- Dimensional analysis of the part (thickness, point coordinates, curvature, drilling, internal turning diameter, list of points, etc.)
- Quick, precise comparison between the machined part and the original CAD model
- Dynamic 3D cross-section and exported 2D cross-section

Moors further explained: "To test and try the capabilities of our newly acquired CNC machines and the G-code processor to make sure it could cover all machine and programming functions, NCSIMUL developed a test part called a GP2R that covered 99 percent of our 5-axis capabilities and that we machined to tune the G-code output exactly at the level of our requirements."



Toolpath optimization with Optitool module:

"After that, all NC code was safely sent to the workshop and run 100 percent collision-free; we worked with the NCSIMUL team to go one step further to reduce cycle time and improve tool life. We found this solution within an NCSIMUL Machine module called Optitool," said Moors.

Optitool analyzes cutting conditions, dramatically reduces "air cutting," optimizes feed rates, and allows users to create better cutting strategies. Benefits include a reduction in production cycle times, enhancement of cutting operations, and rapid generation of new G-code files for future applications.

Optitool in a nutshell:

- Analysis of cutting parameters for each section in a block
- Generation of alarm logs based on user-defined criteria (e.g., maximum cut depth, etc.)
- Optimization of approach and retract motion (air-cutting reduction)
- Optimization of cutting parameters according to the tool-material pair
- Display of the toolpath based on feeds
- Graphic comparison between the initial program and the optimized program
- Rewriting of the ISO program based on optimal feeds and spindle rotations to be used during machining

"With Optitool, we were able to quickly and confidently optimize all NC programs that had run for some time on our machines and automatically reduce cycle time without changing our programming processes or programming time dedicated to new production. We were able to save hundreds of hours of machining time and secured a ROI of below six months for NCSIMUL Machine."

What about the future functions and modules from NCSIMUL to support Tonasco growth?

"First, and from the beginning, NCSIMUL appointed a strategic partner to work with us in Malaysia. WCS Solution is a local digital-solutions provider that brought expertise, support and training to the local team. Our young engineering team can benefit from this local support whenever it is necessary so that no question stays unanswered. Each time we have a new CNC or a new need, we get the support from WCS for the implementation," Moors said.

"Regarding our future, we will hopefully be opening new buildings where we are planning to implement new modules and solutions from NCSIMUL, even more now that NCSIMUL is part of Hexagon Manufacturing Intelligence, which links real and digital worlds. We will be having a look at the automatic technical documentation with NCDOC, the automation module for simulation and optimization to be automatically run at night or to precisely calculate our machine tools' real-time states and workshop OEE with the last NCSIMUL DNC and monitoring module."

Case Study Summary

Company name: Tonasco

Website: www.tonasco.com

Business: Precision components

Key benefits achieved:

- Improved cycle time and tool life
- Reduction of time spent on manual prove-out by up to 80 percent
- Confidence that machining will be collision free

Categorisation:

Industry: Other Industries

Segment: Machine Shop

HEXAGON

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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production and metrology to make manufacturing smarter. For more information, visit hexagonmi.com.

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