

SIEMENS

Ingenuity for life



Digitalization for machine tools

On the way to Industrie 4.0
with SINUMERIK

[siemens.com/sinumerik](https://www.siemens.com/sinumerik)

The way to digitalization

Digitalization is radically and sustainably changing the production environment. As a consequence, machine builders and companies operating machine tools can more flexibly address market requirements, shorten their time to market and increase their flexibility as well as efficiency. In addition to developing and manufacturing machine tools, digitalization also impacts their use in series production and in workshop-oriented production facilities (for example job shops). At the same time, the link between humans, machines and systems across the complete value-added chain is becoming increasingly more important.



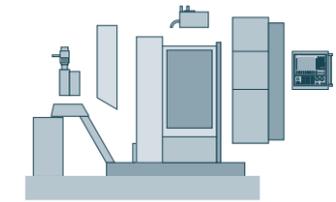
In the machine tool domain, Siemens offers digitalization solutions that extend from the first idea for a new machine tool up to its operation and ongoing optimization. The consequential use of all the possibilities offered by digitalization opens up completely new business potential. For machine builders and companies operating machine tools, Siemens offers digitalization solutions for:

- Building machine tools (Build)
- Operating machine tools (Operate)
- Optimizing machines and production (Optimize)

For a Digital Enterprise, the following questions are crucial:

Building machine tools

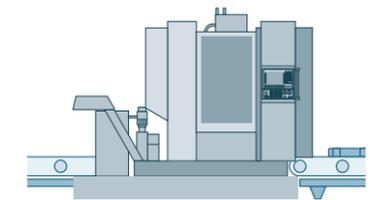
Build



- How is mechanical and electrical development made more efficient?
- How can automation engineering be made more efficient?
- How can production processes be made more efficient?
- How can value-added be generated for the machine?

Operating machine tools

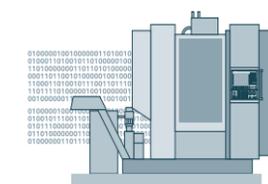
Operate



- How can machine operation be made more efficient?
- How can high quality part production be guaranteed – and at the same time productivity boosted?
- How can production performance be optimized?

Optimizing machines and production

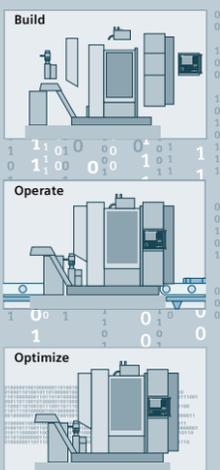
Optimize



- How can machine performance be optimized?
- How can production performance be boosted?

Digitalization in machine tool manufacturing

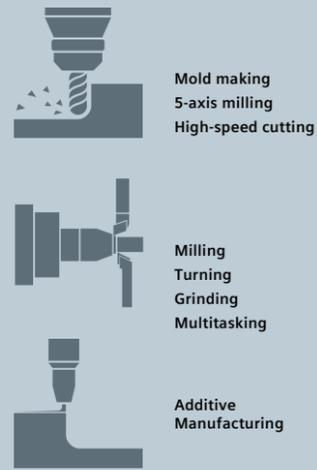
Digital Enterprise



SINUMERIK



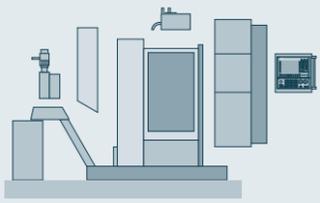
Technology



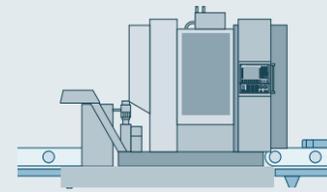
The Digital Enterprise challenge

When all is said and done, the quality of the produced parts is what really counts – and this is also true when it comes to digitalization. The integrated Siemens portfolio of industrial software and automation solutions along the complete value-added chain plays a significant role. And this is complemented by Siemens know-how in the various technologies, which is also a crucial factor.

With tightly meshed software and hardware, as technology leader, Siemens supports manufacturers of machine tools as well as companies operating them on their way to becoming a truly "Digital Enterprise." And in so doing, Siemens is driving digitalization in the complete machine tool environment.



How can machine development be made more efficient?



How can high-quality part machining be guaranteed – and at the same time productivity increased?

Build: Quickly and flexibly from the idea to the machine

To be able to quickly and flexibly respond to market and customer requirements, machine builders are increasingly developing new machines in virtual environments and in parallel. The precondition to achieve this is the consequential use of all the possibilities offered by digitalization – from the first idea up to commissioning the finished machine.

Digital twin boosts flexibility

Through the digitalization of the development process, machine builders have all of the required data as virtual machine model at a very early phase – thus allowing a digital twin of the machine to be created. This also means that the feasibility of customer requirements and new options can be directly and simply checked and optimized.

Virtual CNC commissioning shortens real commissioning

With integrated software and hardware solutions on a common database in the NX Mechatronics Concept Designer, Siemens plays its role in significantly shortening the machine development process. Through virtual commissioning, the capital-intensive phase of the actual commissioning can be significantly reduced. To achieve this, the virtual machine model is linked with the real control technology – the SINUMERIK system. As a consequence, machine functions can be tested and further optimized under conditions that are very close to those encountered in reality.

Increased safety by using the virtual environment

This approach offers machine builders the maximum degree of safety and security. Possible damage to the real machine can be avoided during the commissioning and run-in phases. An additional advantage: Machine builders can test their programs for part machining at an early phase under what are essentially real conditions – but in a virtual environment.



! The result: A significantly shorter time to market – as well as higher productivity and efficiency in the machine development process

Operate: Simply and efficiently from the design to the workpiece

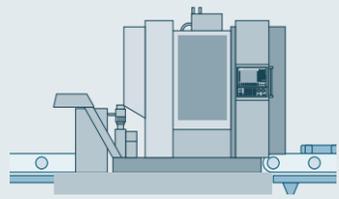
Companies operating machine tools have some significant benefits if the machine builder also supplies a virtual machine image in addition to the real machine. They then have a virtually identical production planning station where they can plan and optimize all of the production steps. For instance, the machining strategy for a new workpiece can be checked out in the virtual machine and run in while the real machine is producing other parts. This reduces the equipping time and plays a significant role in achieving a higher profitability.

Optimizing production planning

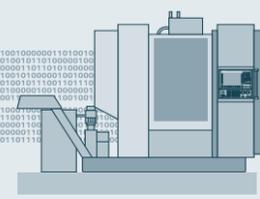
Machining can be simulated in advance under almost the same conditions as in reality using the original SINUMERIK software – the “virtual NC kernel” (VNCK). The advantages when operating machines are crystal clear: Production planning and machine utilization can be optimized, and workpiece costs can be precisely determined using the calculated main machining time. Siemens is therefore providing a solution with which machine availability can be significantly increased: the optimized CAD/CAM-CNC process chain in production planning, including control-specific simulation with a high degree of precision. This allows processes extending from the product development through to production to be efficiently configured without any errors. NC programs generated in this fashion can be directly transferred to the machine and executed.



! The result: Machine availability and profitability are increased



How can production performance be optimized?



How can machine performance be optimized?

Operate: Intelligent integration of machine tools into production processes

Networking production planning and production as well as machines is a precondition for error-free program and data transfer.

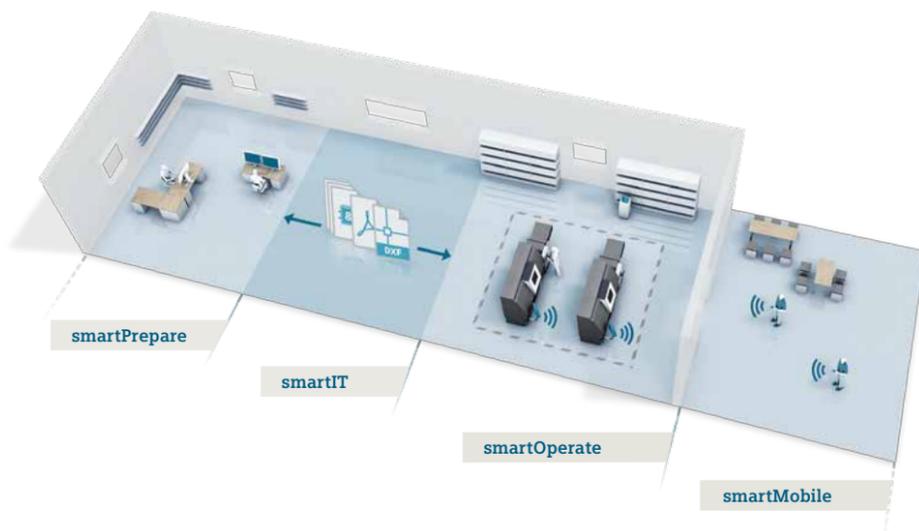
SINUMERIK Integrate facilitates that programs can be directly transferred to machines. Using the Manage MyPrograms module, NC program data can be managed throughout the plant. This enables detailed planning of workpieces, orders and series parts in production.

Tool requirement at a glance

Manage MyTools provides a centralized tool data management in order that the correct tools are available at the machine as requested by the program. This means that tools required for production orders can be quickly and efficiently determined.

Networking in job shops

Job shops are also increasingly striving to intelligently integrate machine tools into production processes. With smart operation, Siemens has developed a leading-edge portfolio for these types of companies. With smartPrepare, a part can be programmed offline at the PC in exactly the same way as at the control. With smartIT, documents are available directly at the operator panel in digital form – and data storage limits are now a thing of the past. smartOperate opens up new operating options based on touch technology. And with smartMobile, the workshop foreman always has a precise overview of parts inventory, order status etc. of his machines on a mobile device.



The result: **Efficient processes and increased productivity**

Optimize: Continuous optimization of machines and production

Ongoing operating costs make up the largest percentage of the life cycle costs of a machine tool. Ongoing operation must be improved in order to minimize unit costs. In production, most of the optimization potential involves maintenance and monitoring the machine state. Networking the complete production environment has a significant positive impact.

Increasing efficiency by monitoring key parameters

Based on machine and status data, the SINUMERIK Integrate Analyze MyPerformance module calculates the effectiveness of the overall system (Overall Equipment Efficiency – OEE) and supplies important information on measures to boost efficiency. Analyze MyPerformance supplies all of the data to optimize the production environment by automatically acquiring machine data and statuses. Further, it also provides a user dialog to manually enter status data.

Optimizing the cycle time of existing machines

Productivity Improvement has the objective of boosting the productivity of all machine tools that are no longer under warranty. The productivity of machine tools can be increased by up to 15%, for instance by modernizing the control hardware and software. Increased productivity also results in lower unit costs.

Optimization potential for machine builders

Irrespective of whether modernization or development: machine tools must be quickly available for the market. Mechatronic Support models, tests and optimizes the functionality of all the mechanical, electronic and IT systems involved in a simulation environment. This means that machine concepts can be mechatronically tested and modified in a short time and with low associated costs.

An even higher machining performance is achieved using technology functions embedded in SINUMERIK – such as Top Surface. Compensation cycles like nick compensation further optimize machining.



The result: **High degree of transparency and reduction of life cycle costs**

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