NX CAM – Siemens Sinumerik Virtual NC Controller Kernel

Integrated validation of machining operations with full machine tool motion

Benefits
- Reduces manufacturing costs by minimizing the need for prove out and first-article machine trails
- Provides highly accurate cycle times that ensure reliability of your validation process
- Increases component manufacturing throughput
- Increases factory floor confidence
- Facilitates better scheduling by delivering more accurate cycle times
- Validates entire machine operation
- Facilitates flexible process refinement and value engineering by enabling rapid tooling layout and design changes

Features
- Driven by a virtual NC controller
- Full simulation of entire machine tool motion
- Support for controller, vendor and user cycles/subprograms
- Collision detection simulation between solid objects and clearance envelopes
- Actual machine datums utilized to ensure maximum accuracy

Summary
By combining NX™ CAM software with the embedded Virtual NC Controller Kernel (VNCK) from Siemens' market-leading Sinumerik 840D controller, manufacturers can attain a new level of accuracy and completeness when using 3D simulations to validate their machining operations. The integrated solution enables your company to perform highly accurate simulations, thereby ensuring the reliability of your validation process and reducing manufacturing cost by minimizing your need for prove out and first-article machining trials.

The integrated Virtual NC Controller Kernel solution enables you to validate the operation of an NC-driven machine tool by driving its kinetic motion in a 3D solid assembly model and simulating a motion study entirely within NX CAM.

In this scenario, programmers validate an NC program by having NX CAM post process the program's tool paths and send the posted output to the embedded Sinumerik controller kernel. In turn, the controller kernel processes the data exactly as it would on a real machine and drives the 3D machine-tool model to display the simulation.

This advanced level of simulation enables programmers to inspect and validate entire machining operations, including the computed tool path motions and a machine's controller-driven machining cycles (e.g., drilling, thread cutting and tool changes). These machining cycles and special moves (often called "canned cycles") usually are hard to simulate in traditional verification systems since they require detailed knowledge about how the controller actually executes these cycles.

Instead of relying on a generic software approximation, this integrated approach enables the programmer/planner to compute accurate machining times for each operation and for the entire machining sequence by considering a complete model of the machine that accounts for its performance and response. During the simulation process, users can take

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Features
- Accurate representations of machine tool kinematics
- Machine absolute and local coordinate output
- Flexible motion control, including both single block and full cycle functionality
  - Move
  - Block by block
  - Linearization between interpolated positions
- Simulation driven by the real controller manufacturer's software
- Full 840D language support, including cycles, subprograms, system variables and kinematic transformations
- Operable inside NX CAM programming environment

At your discretion, you can have trained Siemens experts adapt the virtual machine control and simulation solution to your company's individual machine tools-thereby ensuring compatibility with machine tools in your manufacturing environment equipped with Siemens Sinumerik 840D controllers.

The value of virtual simulation
With traditional verification tools, workshops spend considerable time checking new programs on the machine tools in a step-by-step process that includes a complete setup. This time-consuming approach ties up the machine and its operator performing non-productive tasks.

The integrated Virtual NC Controller Kernel solution is driven by an accurate and complete software model that is provided by the controller manufacturer and calibrated for your machine tool. The resulting simulation responds exactly like a real machine with the same tool path and setup. This improved approach enables you to confidently reduce-and in many cases completely eliminate-step-by-step manual checking.

Virtual controller-driven simulation is so real that evaluation of the overall configuration and motion of the machine tool will reflect the exact motion characteristics and velocity profile of the actual machine thereby facilitating

verifications with highly precise cycle times. This approach also ensures that machine selection will be entirely suitable for your manufacturing planning process.

In addition, manufacturing engineers and planners require accurate program segment timings, enabling them to properly adjust your overall manufacturing plan, schedule tasks and account for resource utilization and its associated cost. The Siemens 840D VNCK provides precise motion behavior and timing data that is as close as possible to the results achieved by a real machine.

Technical solution
When the Siemens 840D VNCK is added to NX CAM, the real controller software is used to drive your integrated machining simulation solution. The integrated solution facilitates the closest possible digital representation of actual machine tool motion with highly accurate swept paths, speeds and accelerations and tool changes.
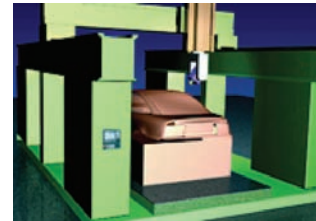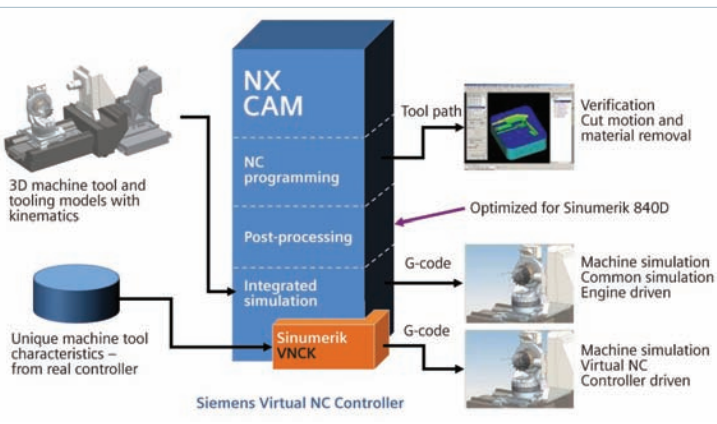

Image Courtesy of Adam Opel AG.

The solution's software is calibrated for specific machine tools with the hundreds of unique performance parameters taken from your real machine and 840D controller installation. By leveraging this data, the NX CAM-NVCK simulation can mimic the system created when your specific machine tool and its Sinumerik 840D controller were commissioned. The 3D simulated motion will represent the precise response of your specific machine tool under NC program control as processed by the Sinumerik 840 controller.

NX controller-driven machine tool simulation.

advantage of the solution's advanced gouge and collision checking tools to ensure path quality, including tool path accuracy and overall tool path integrity.