

- 1 Model of a machine tool.
- 2 Real-time collision detection

EFFICIENT ENGINEERING USING VIRTUAL MACHINES

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Developers and vendors of complex machinery and plants have to complete technically risky projects on time, at cost and to quality. New methods of integrated digital engineering provide valuable support:

Virtual models can be used to

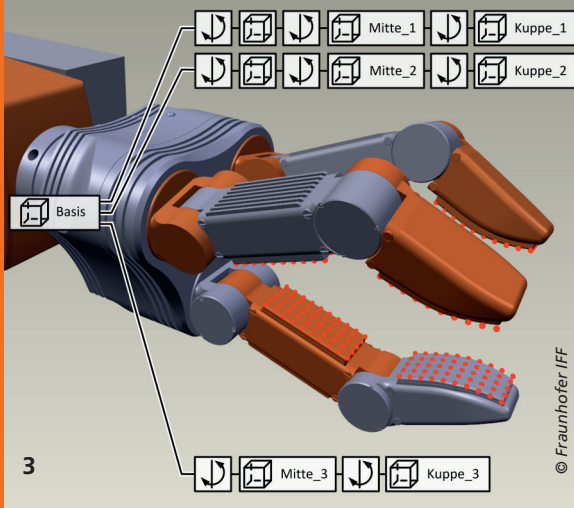
- validate concepts at an early stage,
- parallelize stages of development and
- validate features.

At the same time, they improve coordination among everyone involved in a project, thus reducing errors caused by inadequate communication.

Since the implementation of major engineering systems requires considerable labor, both technically and organizationally, the Fraunhofer IFF developed the software system VINCENT, which is tailored specifically to the needs and capabilities of small and medium-sized machine manufacturers.

VINCENT Simplifies Virtual Modeling

VINCENT makes it possible to visualize machines and their movements as well as to completely test their kinematics physically correctly. A virtual machine is modeled largely automatically from a CAD model. Using the digital interface that connects the real controller (PLC, PC or NC), the control code is tested and the machine is commissioned virtually before it has been built. Design engineers and control engineers collaborate closely from the onset. Real time collision testing detects faulty operations, thus eliminating damage to the real equipment. The real machine is commissioned with validated engineering and tested control code.



Data Transfer with VINCENT

The basis for a virtual model is the equipment's engineering data. They are loaded in the standard STEP data format, thus making VINCENT compatible with any larger CAD system.

Designed for parallel work during development, VINCENT successively transfers machine modules as soon as they have been completely engineered. These modules are assembled automatically. Engineering data that are changed later are imported anew without any problem.

Simple, Fast and Direct Communication with Control Systems

VINCENT simulates the movement of the axes of connected position-controlled motors or pneumatic components on the basis of the engineered drive dynamics (maximum speed and acceleration). To do so, a simple communications protocol for data exchange between the simulator and a controller was specified, which is used for communication with real I/Os, too.

Your Benefits from VINCENT

- Standardized development of machines by design and control engineers
- 70 % shorter commissioning time
- Effective minimization of damage and risks
- Up to 50 % shorter development times

Virtual axes can often be simulated directly in a real controller. For instance, if an NC controller interpolates complex paths, which are also computed without real axes, VINCENT can use the simulation of a controller's axes and directly transfer the nominal and actual data.

How Data Exchange Works

The real-time interface integrated in VINCENT can be connected to a broad range of industrial controllers. A software development kit additionally enables our partners to connect their own software or hardware to the interface and includes methods to distribute the systems on different computers in the network.

Virtual Machines

The basis for the moving model is the machine's kinematic structure. It is specified quickly and easily using graphic blocks, which are linked so that every configuration of the kinematics, including closed and branched chains, can be reproduced. The imported 3D data of the machine are assigned to the kinematic structure associatively (by dragging and dropping). Once the machine structure has been specified completely, the virtual machine can be interfaced with the initialized controller with a click of the mouse. It is immediately monitored in real time for collisions. Short loading times, even for complex models, and functions that record movement as video round out the system.

Online Collision Detector

Collision testing is done online while the control program is being executed and does not employ any distorting simplifications of geometry (e.g. bounding volumes). The results of the collision testing are transmitted as a signal back to the controller where they are used, for instance, to stop machining.

Technology Partner to SMEs

Allow us to use our experience with digital engineering and the software system we have developed to enable you to benefit from integrated and, thus, effective and efficient development of custom machines.

- 3 A model with given kinematics.
- 5 Shorter commissioning using VINCENT.

Image: 4 Dirk Mahler