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1 *Validated commissioning with VINCENT.*

EFFICIENT CONTROL PROGRAMMING

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Complex Machines Increase Controller Complexity

Controller programmers are normally the last in the chain whenever machinery and plants are being developed. Assembly and modification of reused program modules from prior projects, programming of other modules and, above all, commissioning and testing can only be undertaken when the real machine has been built. Consequently,

- the program is produced under tremendous time pressure,
- necessary software testing, especially for errors and exceptions, can only be performed incompletely (following the principle of "perpetual beta"), and
- engineering shortcomings only become apparent on the real machine.

Validate Programming with the Push of a Button

In response, the Fraunhofer IFF developed the VINCENT software environment. The heart of VINCENT is a virtual machine that simulates and visualizes a real machine's functions. The VITES extension module is employed to develop controllers efficiently. It makes it possible to begin programming and testing controllers at an early stage of product development and enables design and control engineers to collaborate from the onset. Desired motion sequences and correlations are easily demonstrated (virtual teaching) on the virtual model of the machine. Related program operations are generated automatically in the background. Comments and remarks can be added at any time and appear at the right place in the control code, thus making it well documented and readable. Then, it is exported as an executable control program with the push of a button.

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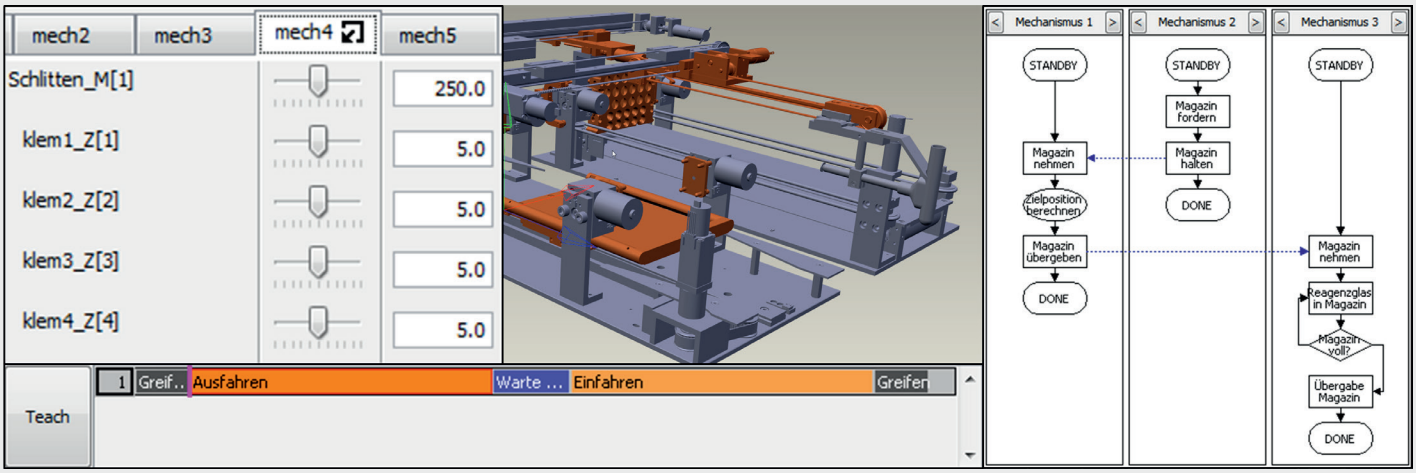

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Along with cutting the time required for programming and commissioning significantly, VINCENT most notably facilitates integrated development of custom machines. Immediate testing of control code on a virtual machine validates programming early on.

Design and Control Engineers Work Hand-in-Hand

A method much like teaching used to program robots is used to specify operations: The virtual machine is moved by shifting its axes. Once one or several axes are in the desired target position, the current actual position of the axes is saved by executing the "teaching function" and added to a timeline as an action.
Actions can be stored sequentially or in parallel. Available actions are:

- motor movements,
- cylinder movements,
- wait conditions (synchronization),
- sensor signals (analog and digital), and
- groups of actions.

Your Benefits from Virtual Teaching

- Easy and integrated definition of operations in a machine
- Reliable and complete transfer of know-how from design engineers to control engineers
- Programming of equipment long before it is built and significant reduction of commissioning time on site
- Quality assurance of controller development

Design engineers simply present movements to show programmers the intended working principle of a machine. This eliminates errors caused whenever unclear, incorrect or even no information is exchanged.

Control Projects Are Created with Structure

The substeps defined in the stage of system design are linked by the controller developer and combined into a complete operation. Logical sequences are used to do this. The design of such primary sequences entails compiling the created motion sequences bit by bit. Branches, parameters and links between the primary sequences are defined. The machine's complete control operation is produced.

Equipment modules and their primary sequences can be linked and synchronized in order to reproduce their correlations and dependencies. This makes it possible to reproduce a complex machine's function fully. The control program has a defined structure.

Automatic PLC Code Generation: Efficient Creation of Transparent Control Code

Once the control structure has been created, the complete motion of every actuator is planned. Then, an operation is automatically converted into control code. Once the control code has been generated, the program can be worked on further in the target hardware's programming system (e.g. Step7) without further ado. The control code is clear and readable. Since operations are visualized, control engineers have an image in their engineering environment, which resembles the operations they have generated. The generated code can be used without modification for virtual commissioning with VINCENT and to control real drives.

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.

2 *Easy and reliable controller programming with VINCENT. Image: 1 Dirk Mahler*