



The virtual winder is a functional and graphic computer model which is connected with the real control system.

The virtual winder facilitates the real work in reality

Training simulator used successfully

Steep start-up curves with new machines mean hard cash for the operating company. Of course, the operating team can only achieve such picture-perfect starts when it is familiar with the machine from the outset. The Voith training simulator now sees to that for the first time. All technical workflows can be already run through in advance independently of the real system.

In contrast to the paper machine that continuously produces with constant speed, a winder works discontinuously. The parent roll is accelerated to operating speed and decelerated in sufficient time before reaching the finished roll diameter. The cut finished rolls are end-glued and discharged. A new core set is supplied and the start glue is applied. The next operational cycle begins. After approx. 5 wound sets the parent reel is unwound. The empty reel spool is lifted

out and the next parent reel is inserted. The beginning of the paper web must be brought to the inserted core set. Depending on the machine type, this is done manually or automatically. With a modern winder, practically all processes can be automated. This increases not only productivity but also work safety. But the multitude of automatic movement courses also involves high control complexity. Movements are carried out pneumatically, hydraulically and

electrically. The PLC (programmable logic controller) coordinates all technical workflows. Precision and dynamics of the drives are the decisive precondition for the productivity of the machine and for the quality of the cut rolls.

The reality

In the ideal case, a fully automatic winder cuts one roll set after the other without intervention of the operator. But in



reality, malfunctions in the process workflow are unavoidable. Paper is a sensitive product. Initial tears, breaks, holes, imperfections or contamination by the glue lead to technologically contingent malfunctions. Damaged or displaced sensors and actuators are causes for technical interruptions in the automatic system cycle. The winder is no easy challenge for the operator. The complex workflows are secured against one another in a complex manner. The number of inputs and outputs processed in the software are even larger than in the case of a paper machine. At the same time, 80% of the programmed functions are necessary to cover the numerous special cases after a malfunction and to get back into automatic mode. A multitude of screen pages are available to the operator on the operator monitors and terminals, so that he/she can configure the automatic mode

and diagnose malfunctions. For safety reasons, many areas of the machine are fenced in and not directly visible to the operator. The comprehensive diagnostic functions and locking displays are important aids for the operator in order to ensure smooth operation of the machine.

In order to prepare oneself for the demanding tasks, nowadays usually only the real machine is available. With on-the-job training, the necessary moves are learned and experience is acquired. Paradoxically, this lasts all the longer the more the machine works without malfunctions. Training in eliminating malfunctions is best done when practically solving problems. But how should this accumulation of faulty automatic workflows be achieved in reality, and who wants to do it anyhow? The virtual winder is a genuine alternative here. Based on so-called hardware-in-the-loop simulation in connection with animated 3-D design graphics, it is a perfect training simulator.

The training simulator

The initial basis is a functional computer model of the winder. This program simulates the entire sensor and actuator system in functionality and dynamics. Connected to the simulation PC are the PLC, the operator workstation and the terminals. The original software of the machine is installed on these devices. No software adaptations for the simulation workflow are undertaken. This ensures that the virtual winder behaves exactly like its real counterpart, down to the very last detail. The 3-D design data is the basis for visualization of the technical workflows. This data

is prepared with a special program and converted to the VRML format. Afterward, courses of movement can be defined. The simulation program activates the animations. Camera positions integrated into the graphics allow viewing of all courses of movement. The zoom function can enlarge every detail.

With the simulator, the entire process workflow of a winder can be represented in real time, in slow motion or in time lapse. Error situations and malfunctions can be activated and repeated as often as needed. And the best thing is: nothing really breaks down and the bothersome cleaning up after a web break is easily taken care of with the press of a button.

Summary

The virtual winder is a functional and graphic computer model that is connected to the real controller. A training simulator is thus available to the operator with which all technical workflows can be run through. The use of the original design data and the original controller ensure that the virtual winder behaves in an absolutely realistic fashion. Secure mastery of complex workflows can be practiced on the simulator without danger and without interfering with production. That is the best precondition for high productivity of the real winder.

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