7 Creating a Model for Virtual Commissioning of a Line Head Control Using Discrete Event Simulation

Steffen Bangsow and Uwe Günther

The increasing mastery of the instrument Discrete Event Simulation and increasing detailing of the simulation models open up new fields for the simulation. The following article deals with the use of discrete event simulation in the field of commissioning of production lines. This type of modeling requires the inclusion of sensors and actuators of the manufacturing facility. Our experience shows that it is well worth the effort. Essential coordination with the development of automation can be integrated in the planning process. The simulation helps to find a common language with all people involved in the development.

7.1 Introduction and Motivation

HÖRMANN RAWEMA takes on the role as a general contractor for many projects. As a general contractor, one task is to coordinate and supervise the construction of the entire system. The construction of highly automated plants abroad is an especially big challenge for the project manager. To ensure the proper functioning of the plant components, we typically use a multi-stage acceptance concept (Figure 7.1):

Fig. 7.1 Acceptance sequence

Steffen Bangsow
Freiligrathstrasse 23
08058 Zwickau
Germany
e-mail: steffen@bangsow.net

Uwe Günther
HÖRMANN RAWEMA GmbH
Aue 23-27
09112 Chemnitz
Germany
e-mail: uwe.guenther@hoermann-rawema.de
During the pre-acceptance phase, the ability of the machinery and equipment is tested to meet the agreed-upon requirements. Pre-acceptance may include cold tests (without machining of parts) or sample processing. Deficiencies during the pre-acceptance phase will be recorded. Shipping of plant components and equipment takes place only after eliminating all significant deficiencies and possibly after repeated inspection. This way repair or improvement at the customer site is avoided. Functional tests of line sections examine the function of the machine (with and without workpieces) and the function of the automation technology used to transport materials. For this purpose, after installation of all related technology, the line segments manually "will be fed" with parts. These workpieces are transported either in automatic mode or by manual operation through the line segments. All important operating states are examined (acceptance test). The performance test of the entire system is used to detect the contractually specified performance parameters to the client. The performance test in general consists of a certain production time under full load. Within this context, the performance of the head control components is also tested.

Between readiness for operation of the individual machines and the functional tests of the line segments usually a lot of time passes in practice. This has, among others, the following reasons:

- The integration of automation typically begins only after all system components and machines are set up and functioning. Normally, the construction of automation begins only when the individual machines are installed.
- The programming/customization of the control will start only after finishing the construction of the automation hardware.
- Poorly prepared programs lead to long trial and error phases.

During the software adaptation phase, the system shows a state that is hard to understand for the client. All machines are operational, but the production facility, often worth tens of millions of Euros, doesn't produce one single part for months on end. Additionally, the pressure comes from customers to shorten the installation and commissioning times, while at the same time delivery times of equipment.

![Fig. 7.2 Project time reduction through virtual commissioning](image-url)