Simulation

The future has already begun

modelling

parameterisation

simulation run

visualisation

analysis

optimisation

Why simulation?

An increasing number of tools are required during production and process planning for verification that the system in planning will fulfil all envisioned requirements in advance. The earlier such results are available in the planning phase, the faster it is possible to set the future optimum direction.

The advantages of simulation tool use become apparent when comparing it to a flight simulator. The pilot gains experience by training in the flight simulator, without time expenditure and cost risks, which would occur during direct use of the target system, in this case the aircraft. The pilot learns the necessary skills by experimenting in the simulator. He can make mistakes with impunity in the simulation environment and learn from the results of his errors.

This improves both his skills as well as his decision-making ability leading to greater safety and increased efficiency.

THE INNOVATION

Simulation is a means to learn from future experience

Definition (VDI 3633,1993): Simulation is the mapping of a system with all its dynamic processes into a model to gain knowledge that then can be used in reality.

The possible fields of application range from the simulation of discrete individual events to continuous flow simulation.

When is simulation applicable?

- The system must be able to be modelled, i.e. the processes of the actual system are known and understood in such a way that execution times and rules can be described
- System complexity is so high, that the simulation can clarify possible system interactions and their interdependent influence; analytic calculations of the system are not possible any longer due to the complexity
- Visualisation of the process: 3D representations allow the user to "see" how his plant will behave

Modelling

Modelling is affected on an object-orientated basis. Highly developed objects are used, which emulate process activities and queues.
Complex tasks are simplified by a hierarchical approach.

The inheritability of characteristics and methods permits the design of re-usable simulation objects, which can be reused several times.
All simulation tool aspects can be adapted to the user requirements: Objects, views, user interfaces, menus, selection lists, parameters, to mention only a few possibilities.

9912 1019 GB

Simulation engine

The simulation engine is at the heart of the simulation tool. It processes the events and the resulting data when running the model according to the implemented rules. The engine makes function calls and carries out calculations, generates random values as input data and writes intermediate and final results into pre-determined targets. The use of random numbers is thereby an extremely important principle. A procedure cannot be repeated in reality up to the fraction of a second with the same timing; the simulation considers this fact by providing a large number of different random number generators, in order to be able to emulate natural distributions as exactly as possible as is the case in reality. The decisive difference of the simulation model to a real plant is that the simulation can run in fast motion.

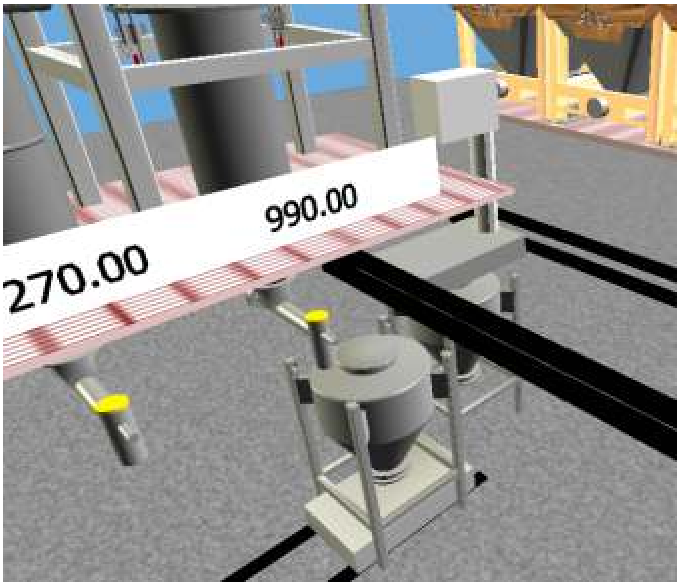
Depending upon the complexity of the model the execution speed can be 10 times, 100 times, 1000 times or even higher than in reality. Therefore daily or weekly productions can be pre-calculated within a short time, input parameters can be modified and statements concerning the appropriate effects, which would only be able to be observed after a few days in reality, can be predicted after a short time.

This also allows creating various scenarios, which are automatically executed by a so-called experimenter. The performance of each scenario can be deduced from a number of pre-defined, user-specific indicators, for example production time, throughput, idle time or costs. The input data and the simulation results can be easily exchanged with Office programmes or data bases.

Advantages of simulation

- Simulation allows the examination of a hypothetical system when planning a new plant and provides analysis results even though no actual plant yet exists
- Simulation offers the opportunity to exchange ideas
  - 3D representation provides a realistic view of the future plant
  - Animation clarifies procedures and system changes
- Simulation can also be used as a training tool, in order to make the plant operators familiar with the system behaviour
- Repeated simulation runs with modified input parameters can be carried out to optimise these input values

Simulation ensures a high quality of planning results. Simulation allows for the consideration of a great variety of planning variants since individual parameters can be changed easily and the individual simulation run can be carried out at a substantially higher speed than would be possible on a physical plant. In this way, the simulation provides data for substantiated decisions and improves the safety of investment plans.



Simulation of a dosing plant consisting of an AZO Componenter and an AZO Dosinenter with interchangeable containers. The simulation model analyses throughput rates with changing recipe sequences. In order to simulate dosing procedures, on-line data from the data base of the production system is used, e.g. material-dependent dosing gradients and conveying parameters, different conveying speeds for coarse flow, fine flow and after-flow.

Consulting and services

- for all simulation task issues analyses your planning or modification ideas
- provides advice and supports you when drawing up alternative strategies
- compiles a complete documentation of the model requirements
- develops the simulation model including documentation of the model realisation
- carries out simulation runs and provides data for analysis of the result
- analyses and presents the results

Concrete objectives of a simulation study could be e.g.

- Higher plant throughput
- Shorter throughput times
- Increase of machine utilisation
- Reduction of staff requirements
- Reduction of storage requirements
- Assessment of constructional variants
- Determination of the number of independent movement shuttles in a componenter
- Determination of necessary buffer sizes
- Optimisation of control strategies

AZO GmbH + Co. KG
D-74706 Osterburken
Tel. +49 6291 92 0
azo-group@azo.com
www.azo.com