



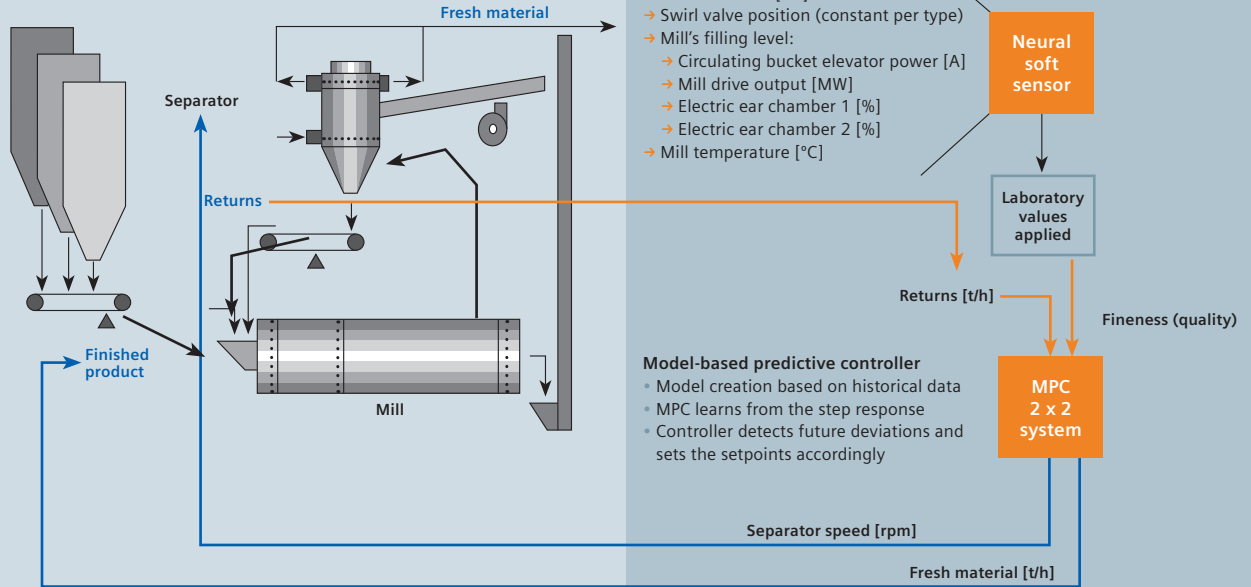
SIEMENS

Cement Technologies

Mill Optimization with SICEMENT IT MCO

www.siemens.com/cement

SICEMENT IT MCO integrated in CEMAT/PCS7



Overview of SICEMENT IT MCO

The challenge

Cement production and, above all, cement milling, are highly energy-intensive processes. The cement mills are responsible for 45% of electricity consumption. The use of expert systems offers a tremendous potential for savings.

The expert system

An expert system is a software system for process optimization that draws valid conclusions about the quality levels of the cement using current plant data (defined measured variables). The expert system delivers continuous values that can otherwise only be determined by a laboratory system at specific intervals. The operator can then use these values to optimize mill control.

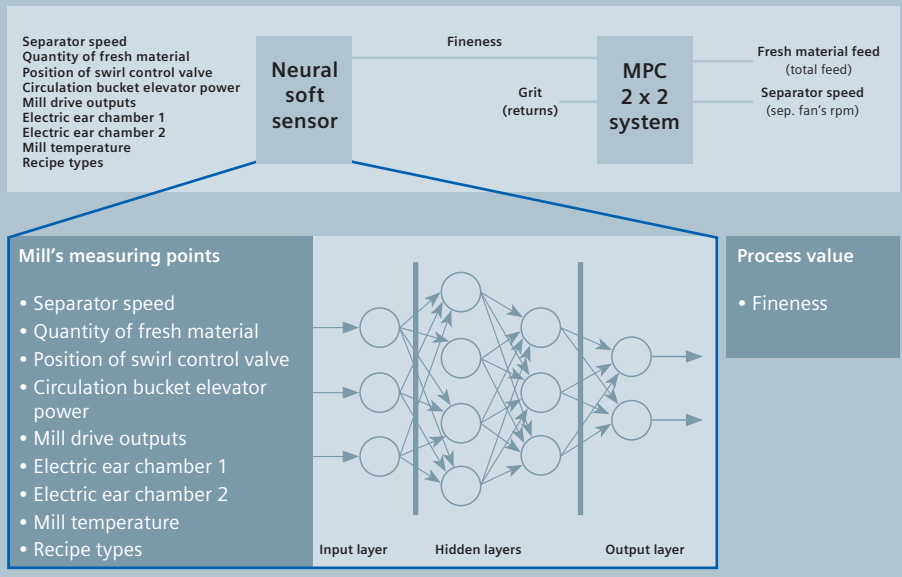
In order to find an approach that meets the requirements of an expert system, SICEMENT IT – MCO uses Siemens' own APC (Advanced Process Control) products. In this way, Siemens can deliver a control system-integrated solution with the support of APC functions MPC (model-based predictive controller) and neurosystems from PCS 7.

Objectives of mill optimization

- **Consistent quality and maximized throughput**
The end products are produced in the optimal area of operation while at the same time throughput volume is maximized, for an additional increase in profitability
- **Lower costs**
Optimized processes lower energy consumption per ton of cement, thus lowering operating costs
- **Higher availability**
The expert system reduces the workload of operating personnel and increases the plant's lifespan through smoother operation.

Neural soft sensor (N) for predicting fineness based on process input variables

Model-based predictive controller (MPC) for controlling fineness and grit by regulating infeed of fresh material and separator speed



Process modeling

Neural soft sensor

Process Modelling

Soft sensor

A multilayer perceptron is used for process optimization.

This neural network consists of layers of interconnected neurons that determine its *structure*.

The perceptron can learn its *transmission behavior (model)*. The SIMATIC PCS 7 add-on neurosystem is used for model development. It permits a valid prediction of fineness

Model-based Predictive Control (MPC)

Multivariable control is described in the model by means of interaction transfer functions. It describes the effect of the manipulated variables on control variables. An optimization procedure helps to select the best manipulated variable strategy. Development of the control model is based on a series of measurements (step tests) and is determined by means of an identification tool.

Thus, the controller has a complete internal dynamic process model, including all interactions. Based on this state model, the controller can make predictions in a specific time horizon (prediction horizon) about the future movement of the process (control variables: CVs) if the controller does not intervene (prediction of free movement, future without control).

Our solution

- 1. Analyze system condition**
Identify existing input and output variables.
- 2. Analyze process sequence**
Identify and analyze existing control solutions.
- 3. Conduct feasibility study**
Test whether SICEMENT IT MCO can be used for the system.
- 4. Acquire and prepare data**
Perform system tests to determine the step responses and acquire production data.
- 5. Develop models**
Create the controller models using identification tools.

6. Integrate into the existing control system

Perform software engineering, adapt the existing SIMATIC PCS 7 control system.

7. Optimize

Check results of production, repeat phases 4, 5 and 6.

8. Documentation and conclusion

Customer benefits

- Complete integration in SIMATIC PCS 7 with no additional hardware
- Reduction of workload for plant operators
- Homogenization of the milling process, for a reduction of mill throughput time and an increase of mill throughput volume
- Consistent fineness of products
- Reduction of energy consumption per ton of cement
- Increase in the lifespan of machinery through smoother operation

The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

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