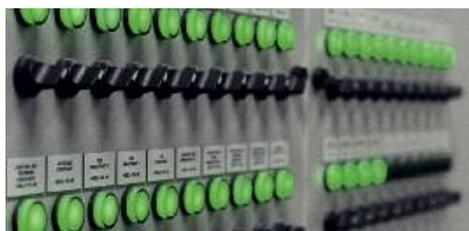


AluControl[®] - Level 2 Electrical and Automation Systems



AluControl® – Level 2

Technological process models

ALUCONTROL® LEVEL 2 SYSTEM

The AluControl® Level 2 system plays a decisive role in increasing the yield of modern aluminum rolling mills. Improving the product quality as well as increasing productivity and flexibility are the main tasks of the Level 2 systems, which are based on mathematical and physical process models.

AluControl® is a part of the X-Pact® automation package from SMS group and particularly takes into account the special requirements of aluminum hot and cold rolling processes.

PHYSICAL MODEL APPROACH

The calculation of the pass schedules as well as of the setting values for profile and flatness is based on mathematical and physical models. Unlike solutions based purely on process adaptation, our models provide a mathematically correct description of the physical conditions and interrelationships. If the material properties are sufficiently known, the Level 2 system is able to calculate sound specified values from the very beginning, even for new products.

If additional product qualities are to be processed on a plant at a later point in time, these can be added to the material database by the plant owner himself.

SYSTEM TECHNOLOGY

Just like the other automation levels, the AluControl Level 2 systems are independent from the hardware used. This is achieved by using a CORBA-based abstraction layer, the SMS group CBS framework. The individual functions can operate either in a distributed manner on several computers, or all on the same computer with a respectively high performance.

For the complex model calculations of the plant setups, the Level 2 systems use high-performance computers with MS Windows.

The communication to external systems – for example a cross-plant production planning system (Level 3) – is designed as an independent functionality in order to ensure high flexibility as regards the different connection options.



PASS SCHEDULE CALCULATION

With the first notification of a slab or strip at the respective plant, as a first step the pass schedule and the drafting pattern are calculated on the basis of the product data and order data. In this context, the plant limitations, such as the maximum available rolling force or the maximum drive torque are taken into account in the same way as the technological limitations. These for example include temperature limits which must be adhered to depending on the material. Further examples are the maximum pass reductions that must not be exceeded due to the material properties.

The most important process models for pass schedule calculation are:

- Roll gap model
- Work roll flattening model
- Material model
- Drive model
- Temperature model including the calculation of the amount of coolant for the roll gap

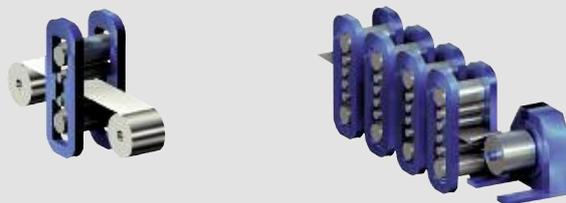
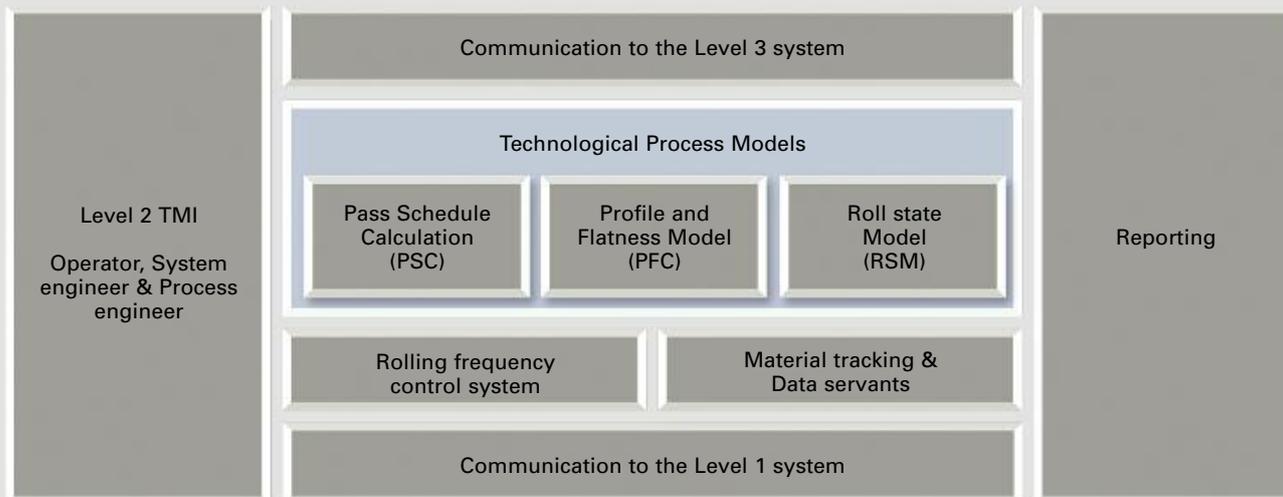
PROFILE AND FLATNESS CALCULATION

For an optimum rolling process, sound presetting of the roll gap is of major importance. Presets that do not suit the process can lead to delays in production and larger off-gauge lengths at the strip head end.

Following the pass schedule calculation, the presets for the respective actuating variables (e.g. roll bending, roll shifting, etc.) are calculated, again using the technological process models. The aim is to thread the strip into the mill without deviations and to achieve the desired strip profile with good strip flatness values.

The following models are used for profile and flatness calculation:

- Temperature model for the work rolls
- Flattening model for the set of rolls
- Roll gap contour model
- Material flow model



Modules of the Level 2 Systems.

HIGH PRODUCTIVITY

The calculations for profile and flatness as well as for the pass schedule always aim at a maximum production throughput while maintaining the required product quality. For this purpose, again the limitations of the plant, the current plant condition, the material properties as well as the product size and the temperature must be taken into account.

In this context, temperature means the strip temperature to be expected on the one hand and the current roll temperature on the other, as this temperature determines the thermal crown of the rolls.

ROLLING FREQUENCY CONTROL SYSTEM

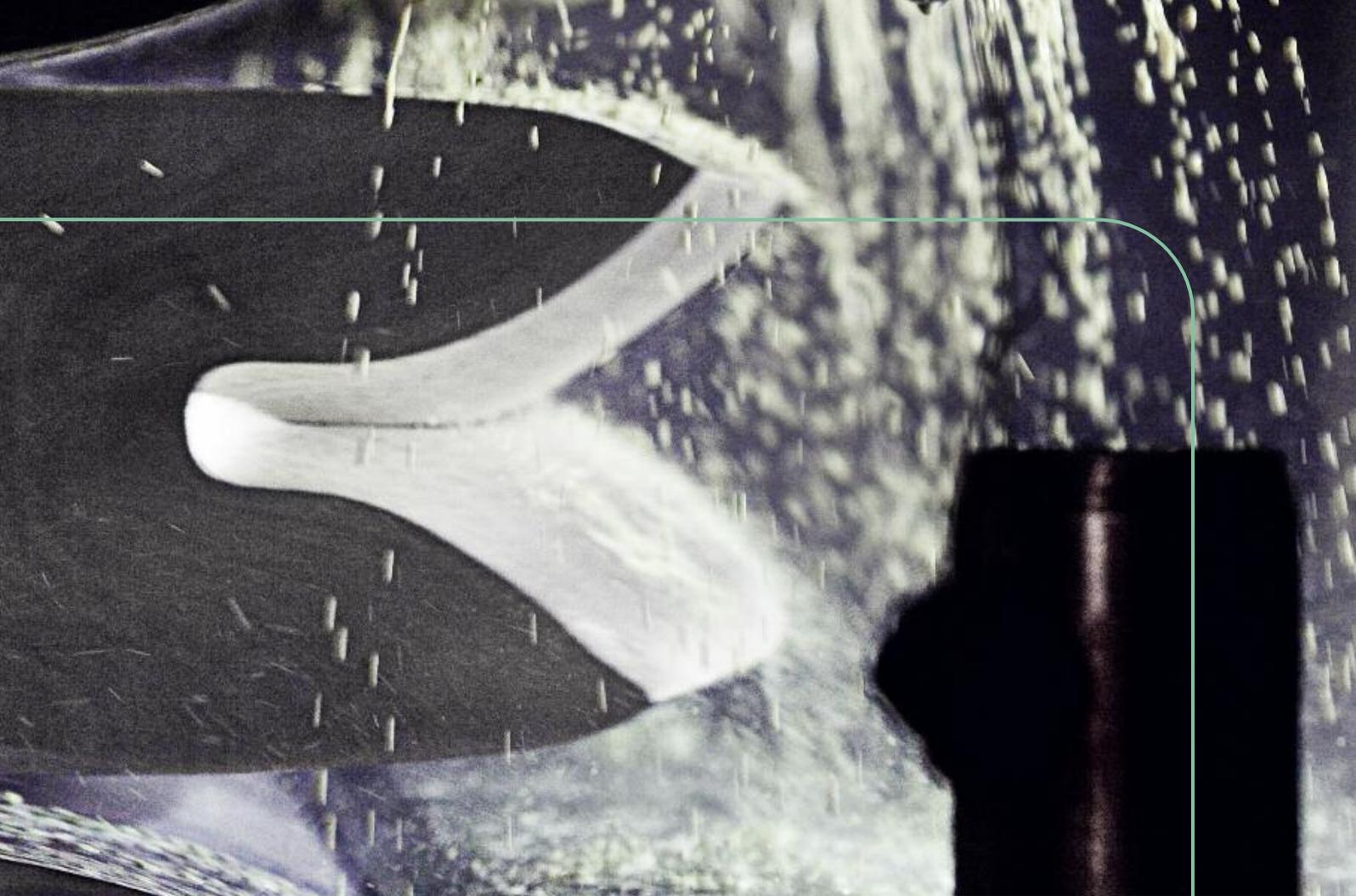
The rolling frequency control system calculates the optimum production interval and in this way determines the ideal point in time for withdrawing the next slab from the furnace. In doing so, planned and unplanned delays, cobbles and failures are taken into account.

PROCESS ADAPTATION

Differences between the specified values from the pass schedule as well as the profile and flatness calculations and the process variables measured during the rolling process are compensated step by step in the Level 2 system by means of short-term and long-term adaptation functions.

Especially for plants processing a broad product range, this adaptation turns the AluControl® Level 2 system into an essential setup tool by means of which the productivity of the plant can be significantly increased.

Even in simple cold rolling mills, e.g. single stands, a process-optimized Level 2 system can complement the experience of long-standing operators, thus ensuring good product quality from the very start.



PRODUCT DATA ACQUISITION AND REPORTING

Within the framework of quality assurance, in addition to the functions for process optimization, the Level 2 systems must also ensure the acquisition of the plant's product data and production data. For storing the process data, our AluControl® Level 2 systems use an Oracle database, in which pass data as well as production- and quality-relevant data are stored in addition to the order data.

From the contents of the database, certain pieces of information can be retrieved and processed for customer-specific presentation at all times and over long periods. The most important production reports which are created from the data of the Level 2 database are the pass or coil report and the actual production report.

PASS OR COIL REPORT

In this report, the header contains a clear overview of the general order data. All of the production information is listed with the pass-related process data. Furthermore, the most important quality data, which are also relevant for the final customer, are summarized in the report.

PRODUCTION REPORT

This report summarizes the passes or strips that have been rolled during a time period specified by the user. Here, the most important production data (e.g. rolling times and speeds) and downtimes of this period are shown. The production reports are usually prepared for a shift or a day.





- Level 3** Production planning systems
- Level 2** Technological process models, process sequencing and reporting
- Level 1** Process automation and control systems
- Level 0** Power distribution and drive systems, sensors and measuring devices

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