



Pulp & Paper

Background

The need to minimise environmental impacts and to optimise operations to bring down costs make technology and process innovation an imperative for the pulp and paper industry.

Spiro MPC

Spiro MPC is a multivariable model predictive control application. The application comes embedded on a small footprint edge device, designed to connect to any control system easily. When embedded with Spiro MPC, the edge device is able to automate control of connected assets and can maintain processes at their optimal operating point.

Example: Spiro MPC applied to rotary lime kiln

A lime kiln is an important unit operation in the production of pulp for paper manufacture, supplying re-burned lime to the recausticising operation. The lime kiln is the largest single energy consumer in the mill. The main objective of lime kiln operation is to produce uniform quality lime. Additional operating objectives include minimising fuel consumption and complying with environmental regulations. Given the long process delays and interaction inherent to the lime kiln, these objectives can be extremely difficult to achieve under traditional kiln operation.

The kiln is operated over a wide range of production rates. In addition to production rate changes, the lime mud feed is cut off for approximately 5 minutes, every 4-8 hours in order to clean the mud filters. These process disturbances can result in a significant variation in lime quality as well as increasing the risk of damage to the kiln refractory due to overheating.

Spiro MPC can maintain required kiln temperature profile by manipulating the kiln firing rate and air flows. Excess oxygen and kiln emissions are additional constraints that Spiro MPC accounts for.

Lime quality is determined by the amount of residual carbonate in the re-burned lime product and is measured by the process operator every 2-4 hours. To facilitate control of this variable, the Spiro MPC solution includes an inferential model of lime quality. Spiro MPC sets the required kiln operating temperature based on inferred lime quality and current lime discharge temperature.

Benefits obtained from Spiro MPC's optimisation of the lime kiln operation include:

- Reduced variability of lime quality.
- Reduced fuel consumption.
- Reduced risk of kiln damage due to high temperatures (kiln refractory and feed equipment damage).
- Overall improvement in kiln stability (rejection of disturbances due to mud filter rewash).
- The potential for increased production where equipment capacity is limited.

- Reduced airflow reduces emissions due to losses and improves overall efficiency through reduced exit gas temperatures.

Spiro MPC & plant-wide optimisation

In continuous process industries, like the pulp and paper industry, there is a need for a control strategy that addresses the challenge of optimising an entire integrated manufacturing facility as a complete holistic solution rather than optimising individual sub-systems. The Spiro MPC solution achieves plant-wide optimisation through cooperative distributed control. Each unit operation has a separate controller, preserving simplicity, but each controller is aware of subsystem interactions so that all controllers in the network cooperate to ensure that a plant-wide objective is achieved.

Spiro Analytics

Spiro Control offers a range of analytics applications that come ready installed on a small footprint edge device designed to connect to any control system easily and capture real-time plant data. Our data analytics applications can be used to analyse process performance, diagnose faults and to infer hidden properties without the need for expensive on-line analysers.

Massive amounts of data are generated at each step in pulp and paper production, but all too often are not well analysed or made visible enough for useful decision support. The digital transformation of these industries only serves to amplify this problem as the volume of data being created is increasing exponentially.

Part of the problem is that traditional approaches to analytics have built-in delays. For example, data may be stored in a data historian or data warehouse for days, weeks, or months before being analysed (if ever). Our solution is based on processing, analysing and responding to data right where it originates - at the edge of the network. Edge analytics allows data to be analysed in real time, immediately after the data are generated. Consequently, any issues in the production process can be identified quickly, alerts generated, and corrective action taken.

Because of the way our solution is configured it means that data applications can be easily used and customised by control and process engineers at site, not just data scientists and software specialists.

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