How Mills are Using QCS Systems to Improve Quality and Productivity
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Introduction

Profitable papermaking means continuous production with minimal deviations from quality specifications. While steady-state control performance is essential, the elimination of waste during transitions such as grade changes and break recoveries is where the greatest economic gains can be achieved. As production rates rise, often stretching the design capacity of the paper machine, Quality Control Systems (QCS) allow you to improve production efficiency and quality.

The past several years have seen some of the most significant new developments in quality measurement and control since the advent of cross direction (CD) control in the 70’s. These developments are targeted directly at areas which are of concern to all producers:

- Improving productivity and reducing losses
- Improving quality while reducing energy and raw material cost per ton

Application of these modern QCS systems provide a new insight into both the product quality and the process. New on-line quality measurements for porosity, strength characteristics, formation, fiber orientation, and non-contacting caliper have been developed and applied over just the past few years. But the difference is, no longer are the quality measurements restricted to final product measurement at the dry end scanners. New upstream sensor arrays are being installed in the former, in the press section, and inside the coating dryers themselves. These new sensor arrays provide visibility in to the process that was never before available. Though the visibility alone provides a means to optimize the process and improve quality, when these new sensors and upstream sensor arrays are coupled with new developments in multivariable predictive control applications for both MD and CD control, the quality and productivity benefits are significantly better.

A few examples across a broad spectrum of applications might best demonstrate the potential of these new developments.

Award Winning Technology applied at Oji

One example of the upstream sensing technology is highlighted in the SpectraFoil MD installations at several of Oji’s mills in Japan. SpectraFoil MD provides an array of sensors embedded in machine direction of the drainage foils. They are positioned under the wire to continuously measure the water weight in the forming section, and provide the paper machine operators with a real-time display of the drainage profile from forming board to dry line.

By working with these on-line sensors Oji improved their wet end operation, reduced their wet end draws and subsequently, their paper breaks. Oji is also using the sensors to optimize drainage rates to improve drying efficiency and formation.

Japan TAPPI recently awarded their prestigious Sasaki Award to the collaborative effort between Honeywell, Oji Paper and Horikawa Works, Oji’s foil supplier. The Sasaki Award is given to a company that has gone to great lengths in contributing to Japan’s pulp and paper industry through innovation of technology.

Two other unique MD sensor array technologies have been developed for, and applied to the paper industry over the past few years. The first is the GelView which uses fiber-optic based sensing technology to measure the degree of coating consolidation or “gelpoint” within the coating dryers themselves. The installations have proven to reduce coating drying energy from electric and gas IR dryers by 15% or more, resulting in both more consistent coating quality and lower energy costs.

Another example of this MD sensing array technology is Honeywell’s ExPress Moisture. ExPress uses compact, fiber optic-based infra-red sensors to measure moisture directly in the press section. Requiring no on-machine power or electronics, these sensors are designed for the harsh and compact press environment, and are used to measure moisture at the pick-up, and following each nip to optimize the dewatering profile of the press. This same fiber-optic based sensor has also been designed into a compact scanner with the ability to reliability measure a near instantaneous (< 2 sec) moisture profile inside the press section, prior to the wet end pulper.
The results from these applications have come from two key areas. First, by controlling the uhle box vacuums, the optimum hydraulic pressure in the nip is maintained as the felt wears. As a result, mills have been able to increase the dryness exiting the press by 0.5 to 1.5%. With the scanning measurement included in the new PerformanceCD Multivariable control strategy, the wet press and reel moisture profiles can be optimized to improve final product quality, and reduce shrinkage to provide more uniform draws exiting the press.

Reducing Fiber Costs with Strength Measurement and Control at MMK

In November 2007, a measurement and control package for strength properties was installed at the Mayer-Melnhof Karton (MMK) Frohnleiten mill in Austria. MMK produces a multilayer recycled board, where Bending Stiffness is the key quality parameter. The sensor and control was installed to provide continuous visibility and control of board stiffness, compensating for variations in incoming recycled furnish.

The sensor measures properties of the sheet with similar techniques as some lab instruments; but does it non-destructively on a continuous basis, and is constructed to withstand the harsh and dynamic environment on the machine.

The collective experiences of this on-line measurement system have demonstrated an effective correlation to these lab tests:

- Ring Crush
- Short Span Compressive (STFI method)
- Bending Stiffness
- MD/CD Ratio

New application tools, like the Virtual Sensor Wizard allow the on-line measurement of extensional stiffness to be correlated to the quality parameter most critical to the mill. It creates a soft sensor which is treated like any other sensor input, displaying to the operator the CD profiles, MD trends, MIS reporting, and most critically, making it available for process control.

This Honeywell measurement and control package is now installed on KM3 at MMK under closed loop control. The mill’s objective is to maintain target Bending Stiffness values by manipulating the amount of mechanical pulp used in the furnish. If the quality of recycled pulp goes down, the Bending Stiffness value decreases triggering mechanical pulp to be added to compensate. If recycled pulp quality goes up, the automatic control reduces the ratio of mechanical pulp. In some grades, where it was once thought the recipe needed 10% mechanical fiber, the control loop actually drove the demand to 5-6%, while maintaining a more consistent bending stiffness. The 0.5-2% reduction in mechanical pulp translates into several hundred thousand Euros annually while maintaining a more consistent quality.

Tying it all together with Multivariable Control

Though many will see potential in these unique new sensors, how do you ensure that you get the best return from investing in new quality measurements?

Perhaps the best way is to integrate these new measurements into the latest multivariable MD and CD control applications. These applications are specifically designed to handle the complex interactions between quality parameters. Multivariable predictive controllers provide optimal coordination of multiple sets of actuators controlling multiple sheet properties. For example, it allows you to bring the CD profiles of dry weight, reel moisture, wet press moisture, caliper, strength, porosity, etc. in to a single CD controller and coordinate the outputs to the headbox, press steambox, remoisturizing sprays, and calender actuators, to optimize the overall quality of the product. The operation of powerful multivariable tuner is easy; using a simple slider on the display, the user can weight the most critical parameters as well as ensure that all of the quality measurements are optimized. This ensures the highest paper quality, maximizes production efficiency, and prevents the actuators from working against each other in complex control situations; saving energy and resources.
One machine producing white top linerboard is equipped with five CD actuators controlling three sheet properties: dry weight, moisture and caliper profile. Slice lip actuators are installed on the primary and secondary headboxes, a steam shower is installed on the fourdrinier, a rewet shower is installed in the beginning of the dryer section, and an induction heating system is on the calender stack. Utilizing Honeywell’s Performance CD Multivariable Control, the mill is now controlling the weight, moisture, and caliper to 0.5% of process, and has also reduced the recovery time due to grade changes, breaks and start-ups. Substantial cost saving are also achieved due to reduced water usage by the rewet shower, therefore reducing drying requirements.

Conclusions

The application of new quality sensors and multi-variable controls provide both new insight into the quality of the product and an ability to optimize the complex interactions on the process. New on-line quality measurements of porosity, strength characteristics, formation, fiber orientation, and non-contacting caliper have been developed and applied across the entire grade range. New upstream sensor arrays are being installed in the former, in the press section, and inside the coating dryers to provide visibility and control of the process that was a mystery in the past. And with the broad acceptance and success of multivariable MD and CD control, today’s quality control system provides the ability to optimize the product quality and the productivity of the machine.

For More Information

To learn more about Honeywell’s QCS System Services, visit our website www.honeywell.com/ps or contact your Honeywell account manager.

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