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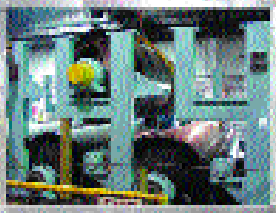

New life in Lynchburg

LAFARGE AND ROCK-TENN TEAM FOR SEVEN HILLS REBUILD

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Programmable electronic motion controllers similar to ones in sawmills prevent refiner plate damage and offer other benefits at the Powell River, B.C., mill

Motion Controller Improves Operation of Refiner Plates at NorskeCanada

By BRAD SMITH

The pulp and paper industry is profiting from a trend that focuses on extending the useful life and improving productivity of existing equipment by retrofitting new control systems. A case in point is the recent upgrade of four pulp refiners at NorskeCanada's Powell River, B.C., mill.

The Powell River mill has three paper machines and an annual capacity of 280,000 tonnes of uncoated groundwood specialty papers and 190,000 tonnes of newsprint. NorskeCanada is North America's third-largest producer of groundwood printing papers and is one of the few producers of sawdust-based pulps in the world.

To obtain better control of refiner plates and prevent their damage, NorskeCanada installed programmable electronic motion controllers. The controllers, which interface with the mill's main distributed control system (DCS), have proven easier to tune and optimize than the old ones. They have also helped the mill achieve less power fluctuations, better operator confidence, and improved trend tracking.

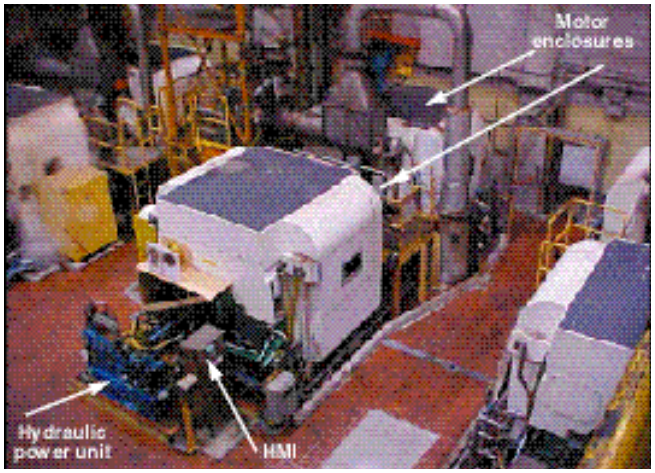
New Refiner Plate Motion Controller at Powell River

The thermomechanical pulp (TMP) refining process involves the fibrillation of wood chips between grooved metal plates in a succession of refiners to produce developed fibers. Each refiner employs a movable plate and a fixed plate—both approximately four feet in diameter. The movable plate is driven by a high horsepower electric motor and is held against the fixed plate by a hydraulic actuator as the force of the conveyed chips tries to push the plates apart. The control process is complex because the intensity of refining varies according to the size and grade of the wood chips, as well as wood species.

At Powell River, the position of the movable plate against the stationary one was initially controlled by a proprietary "black box" controller. However, mill personnel found it difficult to tune and troubleshoot the old rotary dial plate positioning controls. Damage to the plates can occur if they are allowed to collide, yet viewing the actual gap measurement was difficult for the operators.

NorskeCanada's Powell River mill produces 280,000 mtpy of uncoated groundwood specialty papers and 190,000 mtpy of newsprint.

On Powell River's pulp refiners, the refining plates and housing are located between 5,000-hp motors at the feed end and at the control end. The operator interface lets mill personnel set up and adjust plate position locally.



One of the mill electricians familiar with the use of programmable electronic motion controllers in sawmills suggested that the same type of controllers could be used in this refiner plate control application to make the system easier to tune and optimize. Fransen Engineering Ltd. of Richmond, B.C., was commissioned to perform the upgrade, and an RMC100 motion controller by Delta Computer Systems Inc. of Vancouver, Wash., was selected as the controller.

The RMC100 obtains continuous information on the position of the movable refiner plate from a pair of magnetostrictive displacement transducers (MDTs). One MDT is mounted next to the hydraulic positioning cylinder and provides data to the motion controller about the position of the piston. The other MDT is mounted rigidly to the frame of the machine and records any distending to the frame due to the effect of pressure being applied by the cylinder.

The MDTs were added during the control system retrofit operation, replacing linear variable displacement transformers (LVDTs), in order to provide more precise position information. MDTs are highly reliable and have the advantage of providing precise position feedback without requiring a homing step at the start of the motion cycle. Though not mounted inside the cylinder in this application because it is a retrofit, MDTs also have pressure and temperature specifications that allow them to be inserted directly into hydraulic cylinders.

Powell River's RMC100 performs closed-loop control, monitoring the data from the MDTs up to 1000 times per second and then operating the proportional hydraulic valve, moving the piston to make the actual position match the target position. A servo-quality proportional valve is used so that small changes in valve position can instigate very precise hydraulic motion.

The RMC100 controller has the capability to manage pressure and position control simultaneously. In the future, the mill may add pressure control to further improve system performance. Pressure transducers are already in place to support this.

The new controller is interfaced to the mill's main Honeywell DCS via serial and analog connections (Figure 1). The analog link provides the refiner plate position setpoint from the DCS, which obtains the setpoint information from the machine operator via a human-machine interface (HMI) with CRT screen. The serial link carries status information from the controller back to the DCS that can be used for tuning the process.

Programming and Tuning the New Controller

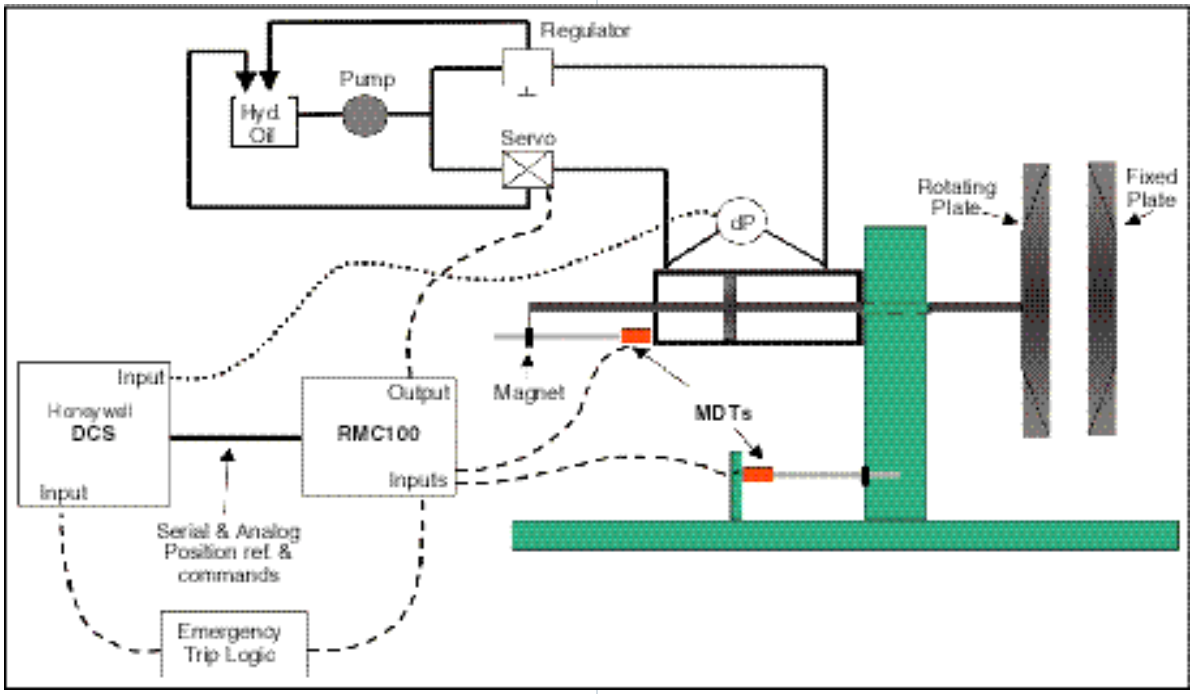
The RMC100 is programmed by writing high-level motion commands in a function table inside the controller, using programming software called RMCWin, provided by Delta. Up to 255 commands can be loaded in a single operation and held in the RMC's internal memory, allowing an entire motion sequence to be initiated by setpoint information from the Honeywell DCS. The Honeywell system is free to handle other control functions while the motion controller manages the hydraulics.

RMC100 motion controller

Though the Delta controllers fit easily into existing systems' hardware architectures, the main key to meeting the performance requirements of applications like the refiner upgrade is that Delta controllers come with graphical tuning tools. Without special tools it is almost impossible to tune fast-moving processes; there is no way to see what is happening in real-time simply by observing the machinery as it moves. The RMCWin software package solves this problem by allowing users to plot actual versus target values of key motion parameters over time, making it easy to see where even small positioning errors occur

FIGURE 1.

This diagram shows how the RMC100 for refiner plate control interfaces to the mill's main DCS.



in order to guide the optimization process.

Though they had no previous experience with the RMC100, the mill personnel found the new Delta controllers easy to program and tune. Once through the initial learning curve, they were able to tune the system themselves.

Benefits of Better Plate Control

With the system upgrade, the mill has gained four main benefits:

1.) *Fast and stable response from the refiner.* For example, electrical power usage by the refiner (measured in megawatts) used to exhibit fluctuations when the older control system moved the plate to compensate for the changing wood chip load. By providing quicker response to changing conditions and more accurate plate loading, the power consumption by the machine has smoothed out.

2.) *Increased operator confidence in the refining process.* The old control system was hard to calibrate, and operators had to frequently visit the refiner, paying close attention to insure correct operation. With the new system, the DCS controller monitors the process closely, and operators seldom need to go out to the refiner.

3.) *Collection of process data that had not been tracked.* For example, during the last eight months, the refiners have been available 97% of the time they were needed. Before the upgrade, this parameter wasn't even tracked closely.

4.) *Up-to-date system.* By selecting vendors of state-of-the-art gear for the control system retrofit, the mill engineers also gained better availability of replacement modules, easier programming capability, and better access to all the parameters for tuning and optimizing.

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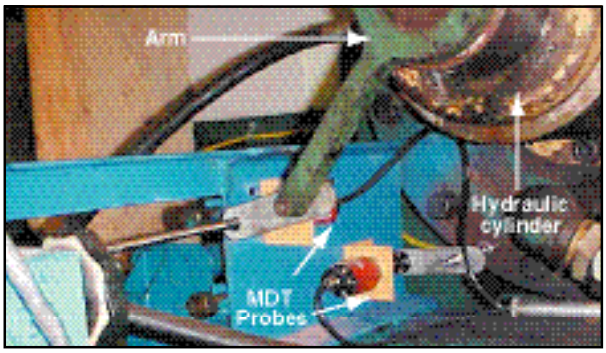
The new controller gets information on refiner plate position from two MDTs. The upper MDT probe's magnet is attached to an aluminum bracket and slides along the probe rod as the cylinder moves in and out, while the lower probe measures the bearing housing's movement as plate pressure is varied. The difference between the two measurements is the gap between the plates.



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