

BrainWave

Control solutions for recycled paper



The challenge: To find cost-effective technologies to upgrade your paper mill



The solution: Advanced control with BrainWave

Perhaps there is no upgrade that stabilizes production and reduces costs like BrainWave—without a large capital investment. BrainWave is easy to install and set up, can be retrofitted to existing processes, and delivers a quick return on investment.

BrainWave is a patented controller, proven since 1992, that can be installed as an up-

grade to any DCS or PLC system. It controls long dead-time processes, reacts before being pushed off-target, handles nonlinear responses, and is both an adaptive and predictive controller. It takes corrective action before you produce off-spec product to keep your process stable. BrainWave's return on investment is measured in months, not years.

BrainWave can be applied to virtually any pulp or paper production process. In fact, it is controlling over a thousand loops in facto-

ries around the world and providing customers with significant savings. In combination with other ANDRITZ technologies, such as DotScan and FiberVision, BrainWave delivers chemical and energy savings—and improved quality.

What is BrainWave?

BrainWave is a patented advanced controller that outperforms conventional Proportional-Integral-Derivative (PID) control. BrainWave outperforms PID systems because of its two main components: an adaptive model and a predictive controller.

BrainWave builds its own live models during normal plant operations, a powerful feature not offered by conventional model predictive control systems.

BrainWave's predictive controller accurately forecasts process responses and accounts for multiple objectives. It adapts to process conditions such as changes in production rate or operating point, keeping your process on target. BrainWave can also accept measured disturbance inputs, like raw ma-

Feature	PID	BrainWave
Controls long dead-time processes	x	✓
Reacts before being pushed off-target	x	✓
Handles nonlinear processes	x	✓
Adjusts to process disturbances	x	✓
Learns while process is running	x	✓

terials properties, and takes corrective action before your process is pushed off target (PID, by comparison, must wait for the error to occur, then react).

Because it uses a standard OPC connection, BrainWave easily integrates with an existing control system. In addition, BrainWave's patented Laguerre technology means an average implementation time of just a few weeks,

saving a remarkable amount in operating costs compared to conventional methods. And, best of all, your own staff can support and deploy BrainWave, making it a technology that you can live with—and one you can't afford to live without.



Success stories

Multi-stage bleaching

In this mill, BrainWave measures the incoming brightness from the thickening and flotation processes and brightness after the bleaching tower.

Based upon the deviation of incoming brightness and the delay time, BrainWave calculates the chemical dosage required ahead of the pulp (feedforward principle) in order to keep the final brightness set point. This ability to model and forecast the process is a huge advantage over conventional PID and manual controls which cannot cope with continuously changing process parameters.

As a result, BrainWave minimizes the chemical dosage required to obtain the final brightness target and stabilizes the overall quality of the bleached pulp. There has been a noticeable reduction in COD discharge to the effluent system.

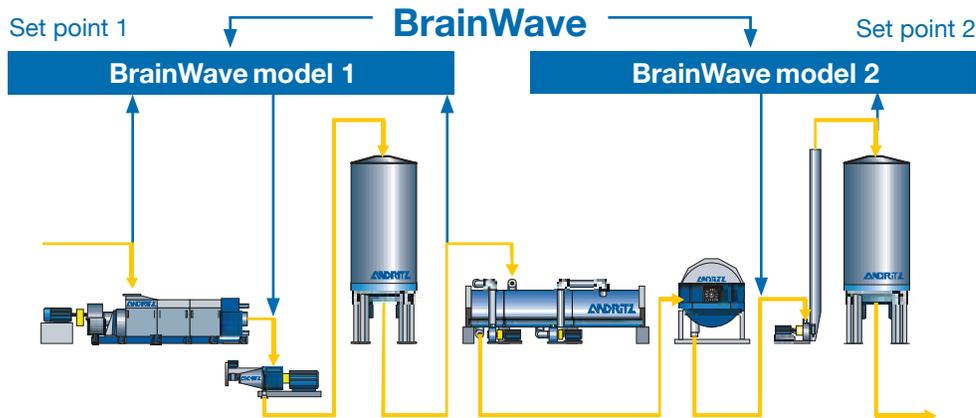
BrainWave control also delivers several significant side benefits. In addition to chemical savings, the mill has documented notable production increases and yield improvements (as a result of using less NaOH, minimizing



silicate, and obtaining stable control of the process). The reduction in NaOH also lowers the COD load in the effluent—providing relief for the water treatment plant, with significant improvement in environmental impact.

Benefits

- Stable process — on-spec production
- Significant reduction in chemical, energy, and raw materials costs
- Quality improvements
- Easy implementation, with fast payback



▲ How BrainWave models fit into a process system

Bleaching of deinked pulp

Before: This DIP line in China has a capacity of 1,200 bdmt/d. Before installing BrainWave, the mill controlled brightness by applying bleaching chemicals in a ratio tied to the production rate. Operators tried to manually compensate for variations in furnish brightness and process disturbances in real time. This became a time-consuming task: monitoring brightness readings around the clock and modifying chemical dosing to try to keep to the targeted brightness. Most of the time, the operators overshot the brightness target to be on the safe side, and there was high consumption of costly bleaching chemicals.

After: Within a very short time after installing the BrainWave controller, the bleaching process stabilized and the results were significant (see sidebar). In addition, the DIP

plant operators were now freed to monitor the overall process and ensure the proper performance of the equipment.

Results achieved in a 1,200 bdmt/d Chinese DIP line

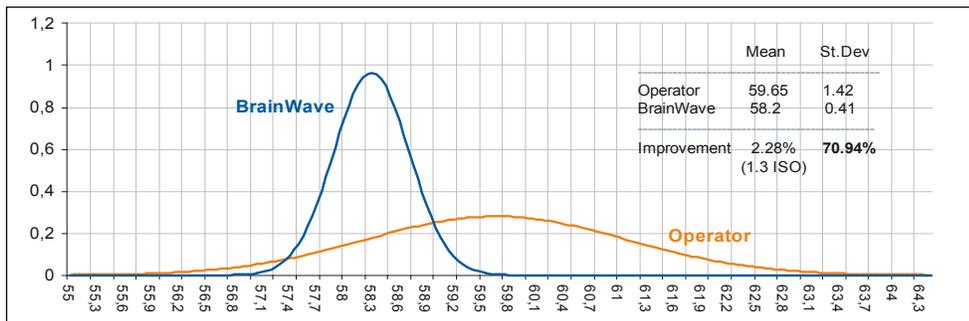
When BrainWave was first installed, a short time was needed for the controller to collect process data and create a control model. Figure 2 shows the immediate impact that BrainWave had within hours of being activated. After a few weeks for optimization and model refinement, BrainWave demonstrated its full capabilities to minimize process disturbances, save chemicals, and reduce operating costs.

Paper machine operators noted that the final product quality is more uniform due to fewer variations. The lower consumption of

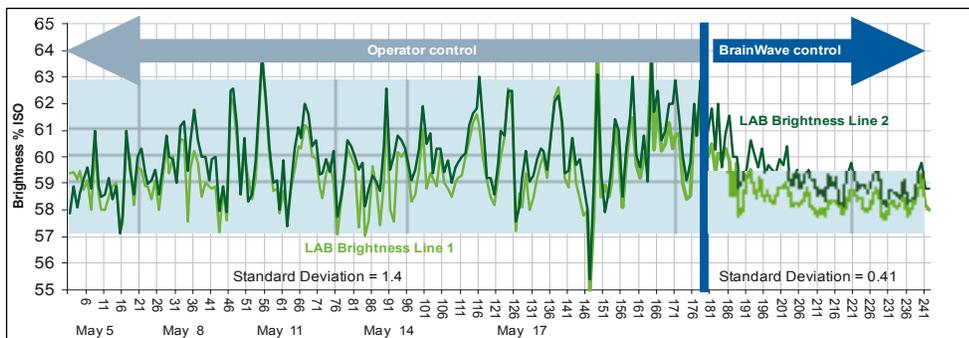
Results

- Reduction in final brightness deviation = 71%
- Increase in overall brightness = 1 pt ISO
- Reduction in bleaching chemicals = \$1/t (annual savings ~ 400,000 USD)
- Return on investment in just a few weeks

bleaching chemicals also contributed to less COD load in the DIP water circuits—which positively impacted the water treatment and environmental aspects of the mill.



▲ Figure 1: Normal distribution, operator versus BrainWave (final LAB brightness)

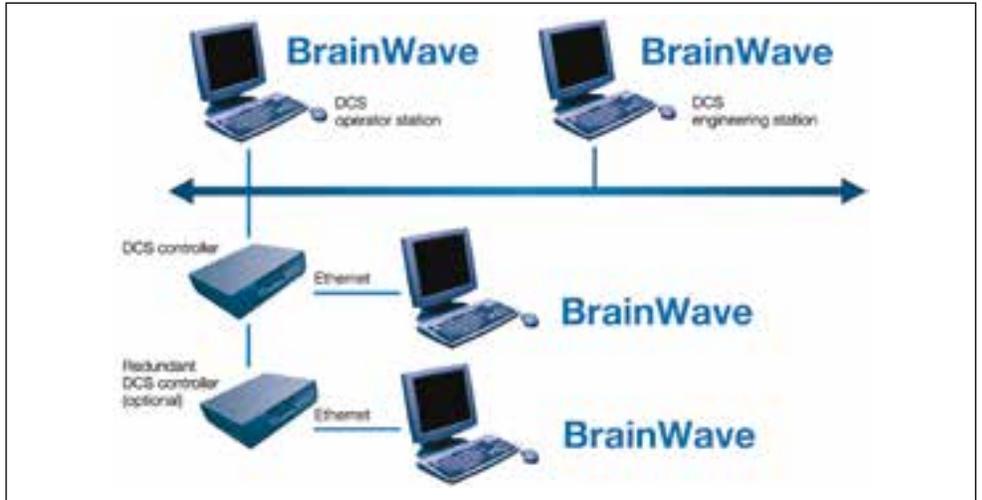


▲ Figure 2: Lab brightness data (May 5 to June 1, 2010)

Process applications

BrainWave can be applied to a number of process applications in a paper mill.

- Bleaching and chemical control: reduced brightness deviation and chemical cost savings
- Stock refiner control: optimization of refiner power and quality control (based on freeness targets and dirt speck measurements)
- TMP refiner control: specific energy and pulp quality control (in combination with fiber property analyzers)
- Disperser system control: disperser performance and bleaching chemical control
- DIP flotation control: improved yield and maximum brightness



▲ How BrainWave fits into an operation's control system





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