FOREST PRODUCTS
Project Fact Sheet

ON-MACHINE ULTRASONIC SENSORS FOR PAPER STIFFNESS

BENEFITS

- Saves 47.3 billion Btu, worth about $190,000, for a 1 percent reduction in substandard linerboard in a mill producing 350,000 ton/yr
- Reduces energy use 10 percent, (73.5 billion Btu/yr), worth $294,000/yr, in an optimal refining procedure
- Avoids repulping and remanufacturing costs
- Decreases moisture entering the dryer by 1 percent
- Decreases water use and wastewater discharges
- Allows use of a higher percentage of recycled fiber than in standard operations
- Reduces the amount of fiber required
- Enhances the uniform appearance and performance of the product
- Improves the efficiency of subsequent converting processes
- Avoids the "hidden waste" of lost fiber quality during drying and rewetting

On-Line Measurement of Paper Stiffness Will Reduce Industry's Costs by Improving First Quality, Saving Fiber and Energy, and Increasing Production

As much as 5 percent of the paper produced each year is considered sub-standard and requires repulping and remanufacturing to improve its mechanical properties and strength. The availability of on-line sensors that measure these parameters during production would quickly signal a drop in paper quality and minimize substandard product. It is known that the velocity of ultrasound can be used to determine various mechanical properties of paper—for example, the square of ultrasonic velocity is proportional to paper stiffness. Technology that measures the transit time of ultrasound through the thickness direction (ZD) of a moving paper web is being developed by the Institute of Paper Science and Technology (IPST), with funding from the Department of Energy's Office of Industrial Technologies (OIT).

Successful implementation of ultrasonic velocity instrumentation will allow the manufacturing process to be controlled to stiffness targets rather than basis weight targets. This will provide more effective use of raw materials, conserve energy, and produce products with improved uniformity and performance. Additional energy savings will accrue because of optimal use of energy during refining and because product uniformity will lead to improved energy efficiency during converting processes.

APPLICATIONS

The new technology will be available to manufacturers of paper products. While it will be applicable to most lines of paper, it will be especially useful in producing strong packaging paper and paperboard.

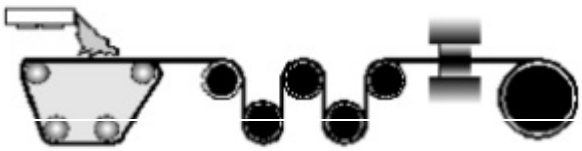

Figure 1. Measurement of paper quality before the reel will permit increased use of recycled fibers and boost the efficiency.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

PROJECT DESCRIPTION

Goal: To develop sensors and instrumentation to measure the velocity of ultrasound in the in-plane and thickness direction (ZD) of the paper web as it is being made on the paper machine.

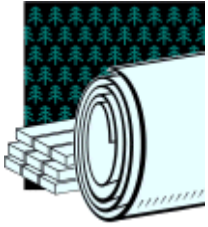
IPST and the Herty Foundation are developing and testing pilot-scale prototype units for measuring both in-plane and out-of-plane (z-plane) ultrasonic velocity. Full-scale proof-of-principle units will be verified at IPST and Herty, and then demonstrated on a linerboard paper machine at a Georgia-Pacific mill in Cedar Springs, Georgia. Testing in a commercial production environment will demonstrate the practical application and benefits of the technology and establish the confidence required to proceed to commercialization of the technology.

PROGRESS & MILESTONES

- An AccuRay® 1190™ System with a Smart Platform™ 1200 has been installed on Paper Machine #1 at the Georgia-Pacific Cedar Springs Mill.
- The sensor carriage in this scanner contains state-of-the-art, basis-weight, moisture, temperature, and caliper sensors. The sensor carriage also has space for the installation of in-plane and ZD ultrasonic sensors.
- ABB has developed, built, and installed an in-plane sensor, and IPST has designed, built, and installed a ZD sensor.
- Both sensors have operated for extended periods of time in the mill while scanning the paper web.
- The system is ready for detailed process-step tests, and end-of-reel testing, to determine correlation of ultrasonic measurements with process variations and mill grade specifications. This will provide a basis for determining the potential economic benefits of the in-plane and ZD sensor systems.

AWARDS, PATENTS, AND INVENTION RECORDS

- Patent US05780744, Out-of-plane ultrasonic velocity measurement. Issued 7/14/98.
- Patent US05719337, In-plane ultrasonic velocity measurement of longitudinal and shear waves in the machine direction with transducers in rotating wheels. Issued 2/17/98.
- Patent US05525854, In-plane ultrasonic velocity measurement. Issued 6/11/96
- Patent US05493911, System for measuring the ultrasonic velocity in the thickness direction of moving webs without errors due to delays in the onset of digitization. Issued 2/27/96.
- Patent US05493910, Method and system of measuring ultrasonic signals in the plane of a moving web. Issued 2/27/96.



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