Institute of Paper Science and Technology at Georgia Tech

Technology Transfer Fact Sheet

Laser Ultrasonics Web Stiffness Sensor
Open for Licensing & Commercialization

MEASURE STIFFNESS OF PAPER AND PAPERBOARD ON-LINE WITHOUT CONTACT WITH IPST & LBNL LASER SENSOR

Overview of Stiffness Sensor

- Measures two fundamental stiffness properties of the paper: Flexural Rigidity (=Bending Stiffness) and Shear Rigidity
- Does not contact the moving paper
- Operates on-machine at speeds from 2 m/sec to 25 m/sec (~ 5000 fpm)
- Current sensor will work on paper or paperboard with basis weights from 35 to 205 g/m² & we are working on increasing basis weight top limit

Sensor Description

The web stiffness sensor uses a recent technology called laser ultrasonics. Laser ultrasonic methods have the potential to succeed in the on-line environment of the mill where traditional contacting technologies have not. A critical consideration for papermakers before implementing a new sensor is the risk of web breaks. As such, they have traditionally been hesitant to embrace technologies that contact the sheet. Also, previous contacting ultrasonic measurement schemes have been difficult to apply to moving paper applications at a reasonable cost and effectiveness. By contrast, the LUSS technology is a single-sided measurement (cf. Figure 1) that requires no contact with the sheet at all.

Figure 1. The LUSS sensor installed on a scanning platform on one of Boise Paper’s paper machines.

In this sensor, one laser is used to generate an ultrasonic disturbance in the web. Another laser is used in an optical interferometer sensitive to the sheet motion, to detect parameters of the sheet that are related to the ultrasonic time of flight over two given distances. A software developed in-house demodulates the signals in real-time to measure the flexural rigidity in light weight papers, and the flexural rigidity and shear rigidity in paperboard grades. Flexural rigidity is the property that determines end-product rigidity and is of great importance to a wide variety of paper grades.
Progress and Milestones

The full scale mill demonstration of this sensor occurred during 2 weeks in a Boise Paper Alabama mill in February 2005, while the paper machine was operating and the results were received very positively by the paper maker (cf. Figure 2).

The sensor development has been funded by the U.S. Department of Energy (DOE) and through internal funding of IPST at GT. The sensor has been developed by two organizations: the Lawrence Berkeley National Laboratory and the Institute of Paper Science and Technology at Georgia Tech.

Benefits

- 100 % web stiffness monitoring during reel construction instead of testing few scattered web samples at each reel.
- Reduced consumption of raw materials and energy by using a lower basis weight and producing less sub-par material.
- Improving web stiffness uniformity by flattening CD profile of the stiffness and reducing stiffness drops at the edges.
- “Selling by the stiffness numbers” possibility for paperboard grades allowing segmentation and pricing advantage.
- Possibility to produce a “super stiff” grade or to displace wood fibers with lower cost materials such as fillers in the sheet.

Reduced fiber and energy requirements translate into lower raw-material costs for manufacturers. For example, reducing the basis weight of an uncoated free sheet by 2 % on a 175,000 metric tpy machine and reducing off-standard paper by 1% of total production result in annual savings of over $1.45 million in fibers, chemicals and energy.

Available for Licensing

Licensing of this technology is currently being explored.

Patent


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