Advances in Sawmill Scanning and Optimization

Scanners were introduced to the North American sawmill industry in the late 1960’s to replace mechanically actuated dial indicators and the operator’s best guess as to the size and the best way to position the log. As log size became smaller and piece count requirements increased basic diameter scanners were introduced. These systems consisted of a single axis “shadow” scanner to measure the log diameter and then go to a “look up” table to select a cutting pattern for each log. Even though the log positioning was left up to the operator there was a significant improvement in recovery.

With the introduction of Dual axis (X-Y) scanners and infinite linear positioners on the cutting tools the “look up” table system became more sophisticated by adding the ability to determine the cutting pattern based on ovality and sweep in the log. As computing power increased, automatic log turning was introduced to replace manual log rotation and the optimization system went to what was referred to as “real time” optimization. Real time optimization is where the optimum solution for each log is based on fitting lumber products into the log model without the use of
any look up tables. This also lead to optimizing based on value and not just volume. To further enhance lumber recovery, the Double Length Infeed (DLI) was introduced to allow for rescan of the log after rotation to optimize the log in the position that it will be fed into the cutting tools. Additional enhancements have also been added to be able to skew the log and profile the side boards for a single pass operation.

In the early 1990’s a True Shape (3D) scanner was developed by the Weyerhaeuser Research and was sold commercially by Advanced Scanning Technology (AST). The introduction of true shape scanning was made possible with the increases in computing power. True shape scanners in the early stages were plagued with reliability and construction of the scanners. They were expensive, hard to calibrate and required enclosures to shield them from ambient light and especially the sun. Also the optimization software that was available was not able to fully utilize the true shape information. By the mid 1990’s additional companies had developed True Shape scanners and they quickly became the standard scanner of choice in North American sawmills.

The True Shape scanning technology has improved with improved light immunity, increased scan rates up to 1000 hertz for logs and as high as 10,000 hertz for board scanning applications. Also in addition to the 3D geometric data, gray scale and laser scatter (tracheid effect) information is also available. Optimization software has also been developed to utilize the data to determine the best value solution for each log.

The future of internal log scanning is on the horizon with a number of companies and research groups working on making the fixed axis X-Rays and/or X-Ray Computed Tomography (CT) scanning technologies a reality for use in today’s sawmills.
Scanner Configurations and Features

1. **Single or dual axis (X-Y) scanning**

Commonly used for simplified log bucking and log sorting systems which are based on log diameter taper and length. In addition single axis scanners are now used in conjunction with the PLC control system to control debarker feed speeds, ring RPM, tool pressure etc. based on log diameter.

Note: conventional X-Y scanners have been replaced with either True Shape or Combination scanners due the high maintenance and reliability of the lower scanner head.
The combination scanner was originally developed to replace a conventional X-Y scanner in a log bucking application to allow for scanning on a belt conveyor without having a break as shown above. This configuration consists of a shadow scanner to the top and bottom points on the log and a profile scanner on each side of the log with a scanner server application electronically filling in the data to create a true shape 3D log model.

Combination scanners are now used in a variety of applications when the scanning conveyor is a belt or the customer has a limitation on their budget the combination is a very cost effective solution.
3. True Shape (3D) Profile Scanners

Shown above is the Hermary LPS 2016 four head scan zone for 600mm log diameter. Hermary Opto has introduced their new DPS 4024 S2 and DPS 4024 VE models of scanners with an increased scan zone of 24” (610mm) wide X 40” (1000mm) deep with the S2 version outputting 3D data from two encoded lasers and two linear CCD cameras and 3D data and gray scale data with the VE version of the head.
Hermay Opto DPS 4024 – Geometric Data

Hermay Opto DPS 4024 – GrayScale Images
SICK/IVP scan zone shown above is a three (3) head configuration for logs up to 750mm in diameter. Sick/IVP has just released the latest model SICK/IVP Ruler E 1200 which has an increased scan rate up to 10,000 hertz, increased scan zone size, gigabit Ethernet interface and also has the ability to provide gray scale and laser scatter (Tracheid effect) data.
SICK/IVP Gray Scale Image

SICK/IVP Laser Scatter (Tracheid)
LMI/Dynavision’s new PL2000/PL2500 scanner is designed with two cameras and a single laser line to eliminate any loss of data due shadowing of the lasers or camera. The only difference between the two models is the maximum scan rate. (700hz for the PL2000 and 1400hz for the PL2500. In addition the scanner is capable of outputting gray scale data.
Scanned Image of Test Log

Photo of Test Log
4. X-Ray Computed Tomography (CT) Scanners

Images courtesy of Forintek Canada Inc.

Test scanner currently used for research purposes is 30X more powerful than conventional medical based CT scanners. It is capable of scanning a log up to 1m in diameter by 5m long in 0.5mm to 5mm thick slices.
In today’s global marketplace, forestry and sawmill owners must maximize the value out of the fibre supply. Advances in scanning and computer hardware have now been utilized in optimization systems available today for improving the value recovery in the order of 5% to 20%. Even larger increases are attainable with the installation of sophisticated breakdown equipment available today. For example, rotation correction, rotary log turners, skewing DLI’s, computerized profiling, and vertical shape sawing.

The dream of “seeing” inside the log appears to be in the forseeable future

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FIEA 2006 March 10, 2006