Scan and Set Logline Automation and Scanning

A Case Study of the Greenfield Logline Installation at TDC Sawmills in Whangarei, New Zealand.

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Tui Technology

- Automation company specialising in the forestry industry.
- Offices in Rotorua and Whangarei, NZ.
- Experienced wood processing engineers.
- Experience with Carriages, End doggers, Loglines, Resaws, Edgers, Binsorters, Length Sorters, Planer mill, MSG, Log and timber handling etc.
TDC Sawmills

- Operated since 1995 in Whangarei, NZ
- Ernst and Young 2002 Entrepreneur of the Year – Manufacturing Division
- High growth company
- Privately owned. Directors are Tony and Clare Davies-Colley

Project Overview

- Log Infeed, including log reject and turner by Kitsell Oy of Finland.
- Debarker by Valon Kone of Finland
- Hew saw SL250 Trio Logline from Veisto Oy of Finland
- 2 Binsorter and Stacker lines imported as used equipment from Canada
- All machines automated by Tui Technology Ltd
- Scanning and Optimisation by Perceptron USNR
Logline Machines

1. Log Scanner
2. Log Rotator
3. Chipper Canter
4. Cant Scanner
5. Cant Saw
6. Board Separator
7. Cant Turner
8. Ripsaw

Following a log through the process.

• Link to video footage.....
Logline Scanning and Control

- Accurate rotation and Curve sawing
- Skewed sideboards
- Scan and set – moving tools between logs
- Log gap – as small as possible
- Radiata – dense and abrasive
- Features for maximum production and recovery

General Cutting Methodology

- Scan the log
- Rotate to horns down
- Chip 4 sides, with vertical curve cant (horns down), full length opening faces
- Re-scan the cant
- Cut 1 or 2 sideboards per side and edge them
- Turn centre cant and mechanically guide through the ripsaw (gang saw). Outer sideboards can be edged.
Log Rotator

- Servo drive controlled dual log rotator with hydraulic servo to lift log into chipper canter and to control curve sawing
- Dual rotation enables turning of short logs at high speed, ie 2.4m logs at 150m/min+
- Second rotator starts to operate at 110m/min
- Scanner Optimiser must use a machine model and log model to lift the log to the correct height and feeding angle, as well as guide the log smoothly through the curve cut
Chipper Canter Infeed

- Infeed tyres and chain guides control curve sawing.
- Maximum curve depends on the width of the centre cant (i.e., the stress on the saws in the ripsaw).
- Optimiser must model curve sawing by feeding through a 700mm section of chain guides into the chippers.

Chippers

- 200kW per chipper head
- Variable Speed Drive to control chip size
- Log fed centred horizontally through the machine, side chippers can be offset
- Optimisation must find the highest value curve solution and offset of side chippers
Cant Scanner and Cant Saw

• Two sideboards per side, edging units after the saws
• Edging units on hydraulic positioners to move vertically to cut a skewed sideboard
• Problem with detection of slip on the cants, ie encoder on a lazy roll
• Optimisation must find the highest value board solution with skewing
• Cant scanner re-scans the cant to re-check and re-position sideboards.

Cant Scanner Benefits

• The actual cant can differ in shape from the predicted cant.
• Can be due to rotator slippage and knots riding through feed rolls
• Log geometry may mean that log doesn’t feed perfectly centred
• Cant scanner essential to reposition the predicted sideboards.
• Gives the optimiser a chance to cut different lengths or widths (thicknesses cannot change)
Board Separator and Cant Turner

- Knock-down arms positioned to outside of the centre cant.
- Stoppers and lug chain timed to index boards out to outfeed belt
- Cant turner lifts and turns the end of the cant to orient for ripsaw feeding using hydraulic positioners

Ripsaw

- Ripsaw accepts cants up to 250mm high
- Fixed saw spacing with variable thickness centre piece
- Up to 4 saws per side
- One edged board per side (since cant tends to have wane on the sides, less on top/btm)
Control System Design

Siemens totally integrated automation including:
- S7-400 high end industrial PLC
- ET200S Remote IO stations
- ET200S plug-in motor starters
- Simocode Profibus Motor Starters
- WinCC Scada Package for operator screens
- Profibus devices such as Delta RMC hydraulic positioning controllers and Danfoss Variable Speed Drives

Siemens Control Components
Diagnostics

Central diagnostic computer to configure:
• Multiple PLCs
• Over 50 Variable speed drives
• Over 70 Hydraulic Positioning Axes
• Scada System
Using ethernet, profibus and serial interfaces
Enables simple support and fault finding by site staff and remote support engineers

Scanning and Optimisation
Tricam Scanning System

- Used for high resolution stem, log, cant, flitch scanning for merchandising systems, end doggers, loglines, edgers.
- Dual laser lines for double the lineal sample rate, the choice for high feed speeds.
- Mounted to capture a scan zone of 550mm dia on this logline.
- Four triangulation heads per log/cant scanner
- Simple and repeatable calibration using a target object and test pipe

Millwide Optimisation Software

- Perceptron USNR’s software used in every wood processing scanning and optimisation environment.
- Used on the TDC Log Scanner and Cant Scanner Systems
- Backup computer also used for performing production simulation and diagnosis
- Coupled with Mill Wide Web Information System for production and management data processing, warehousing and reporting, including XY log reject scanner, USNR log scanner, USNR cant scanner and binsorters.
Optimisation Features

• Evaluation of machine features:
  1. Skewed sideboards
  2. Curve Sawing
  3. Asymmetrical # Sideboards
  4. Offset chipping in centre-fed chipper canter
  5. Opening Face Limitations

1. Skewed sideboards

• Skewing is possible on 2 sideboards per side at the cant saw and 1 sideboard per side at the ripsaw
• Skewing is controlled by vertical movement of the 12 edging heads, coupled to the linear movement of the cant
• Skewing allows higher recovery especially with log sweep and shape defects, allowing the most use to be made of the log taper
• Predicted increase in recovered board volume with skewed sideboards is 0.7%
Example without skewing

Example with skewing
2. Curve Sawing Feature

- Curve sawing is limited for larger centre cant sizes, due to increased stress on the blades in the ripsaw
- The accuracy of curve sawing depends on the optimised solution for the infeed guiding devices
- The predicted increase in recovered board volume with curve sawing is 7%
3. Asymmetrical # Sideboards

- The EK2 separating arms are used to knock down the sideboards to ensure separation
- Normally this would limit the solution to the same number of sideboards left and right
- Some solutions benefit from having an extra sideboard on one side only
- The predicted increase in recovered board volume with asymmetrical sideboards is 0.8%
Example 1 with asymmetry

Example 2 with asymmetry
Offset Chipping

- Logs are feed through centering feedworks
- Offset (non-centred) chipping gives the optimiser another degree of freedom
- Amount of offset is limited by the machine outfeed (cant is re-centred on the outfeed)
- The increase in recovered board volume with offset chipping is 0.4%

Example with centred chippers
100% Opening Face

- Recommendation to have 100% opening face to ensure correct feeding – both in terms of press rolls and centering
- Possible in the future to experiment with reducing this requirement
- The predicted increase in recovered board volume by reducing the minimum opening face length from 100% to 90% is: 2%
Example with 100% Opening Face

Example with 90% Opening Face
Issues with Scan and Set

- Moving all positioners into position reliably
- Minimal log gap (log gap increases with speed to allow for setting time)
- Tracking of logs far more important with Scan and Set (queueing errors will cause jam-ups)
- Tuning of line more difficult since a variety of log shapes and sizes in one run

Control of Log Gap and Line Speed

- Log Gap adjusted at the end of each conveyor by adjusting variable speed drive to control the log/cant position.
- Log gap increased if the tools at the next machine are slow to position.
- Line speed limited if cutting tools come into a heavy cut.
Log Gap Limitation

- Based on two factors:
  1. The length of the longest cutting tool (setlock distance)
  2. The line speed/ required time to set
  3. These two factors must be optimised at each point in the line