Advancements in Curve Sawing Technologies

- Optimising sawing using internal log characteristics -

presented by

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Topics

- **Introduction to EWD**

- **Case Study:** Optimised Chipper-Canter Bandsaw Line for industrial and Pruned Radiata Logs using different optimising strategies

- **Future possibilities related to internal log characteristics for industrial pine mills**
**Introduction to EWD**

* 1862 „Esterer Maschinenfabrik und Eisengießerei“ was founded

- Joseph Esterer

* Esterer company in 1890

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**Introduction to EWD**

* 1900 „Esterer AG“ went public at the Munich Stock Exchange

* Products: Sawmill and farming machines, mobile and stationary steam engines
Introduction to EWD
1950-1983

- **1950 - `75**
  Heavy duty „HD“ sash gangs for export

- **1983**
  Optimising edger with optical scanner

Curve sawing of S.Y.P. in Texas

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Introduction to EWD
1984/1986

- **1984**
  Bandsaw headrigs and carriages
- **1986**
  Quad bandsaws with merry-go-round

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Introduction to EWD
1997

- Merger of Esterer AG and Wurster&Dietz trading as EWD – Esterer WD GmbH

Introduction to EWD
2006

- Combined 5 axis milling and turning machine $x = 6\text{m}$ $y = 1\text{m}$ $z = 1.2\text{m}$
Introduction to EWD

2007

- Linck acquires EWD
  - 320 employees, including 25 apprentices
  - Main products: Circular sawlines
    Highspeed profiling lines

- EWD
  - 270 employees, including 23 apprentices
  - Main products:
    - Bandsaw lines
    - Edger optimizer systems
    - Circular saws

- International project cooperation with:

Introduction to EWD

Headquarters of EWD in Altötting (Bavaria), Germany
Introduction to EWD
The global markets of EWD

EWD - sales partners | EWD - customers outside Europe

QuadroLine
Case Study – QuadroLine
Quadro-Reducer Bandsaw Line with active controlled curve chipping

Chile’s most sophisticated green...”

Design specifications:
- Annual Input: 800,000 m³ JAS
- Log diameter range: 22 - 55 cm, sorted in 2 cm top dia. intervals
- 50% industrial, 50% pruned radiata requiring different optimisation strategies
- only 1 sawline
- Export oriented production for many markets → large range of dimensions
- Scan&set operation
- Curve sawing

Case Study – QuadroLine
Reducer Quad-Bandsaw Line with active controlled curve chipping

**Solution:**
4 + 2 + 4 bandsaws, 2 chippers, double arbor resaw, grade sawing, 6 side boards in primary breakdown

**Optimisation:**
according value/volume for industrial logs
according log grade measured in line for pruned logs

**Capacity:**
800,000m³ JAS log intake

**Working time:**
17 shifts/week
Case Study – QuadroLine
Production process: Log break down step 1

3D True Shape Scanning + Optimization
- saw pattern according geometry, log grade and desired products
- auto rotation: normally “banana down” (core is symmetrical to plane of sweep)
- Sideshifting according symmetric or asymmetric cutting pattern after top rescan

Case Study – QuadroLine
Production process: Log break down step 1

Knotty core
The value of center product is less than the value of sideboards. Boards in the “transitional” area can have a “transitional” value.

Value Curve, depending on board position in the log

Sideboards
Potentially clear “transitional” boards
Assumption of low density core area (circle in the center)
Case Study – QuadroLine
Production process: Log break down step 2

First chipper cantner → First Quad-bandsaw symmetric or asymmetric → First side boards + separation

Type of cutting patterns:
- Defined cant sizes and optim. sideboards or
- „Best open face“ and random cant

Case Study – QuadroLine
Production process: Log break down step 3

Knot or density detection → Quality scanning Twin-bandsaw → Next side boards + separation

Potential non-core boards

Quality scanning with Scanner 3

Thickness according to grade 1 or 2
Case Study – QuadroLine
Production process: Log break down step 3

Grade Scanner in Line:
- Trachoid effect for knot detection
- Surface inspection with red and blue channel
- The optimisation decides about alternative cutting patterns according surface inspection (knots):

Different center cant size including a reman possibility (re-sizing the cant before ripping)

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Case Study – QuadroLine
Trachoid Effect

..Scattering“ of laser light depending on the direction of wood fibres
Case Study – QuadroLine
Production process: Cant break down step 1

**Active Curve Chipping with ArcoLine:**

After fixing the cant on a chain bed and passing the True Shape-Scanner, the CNC controlled cantner heads follow the computed cutting path. The decisive effect is the precision - accurate to millimeters - to put the optimization result into practice.
Case Study – QuadroLine+ArcoLine
Production process: Cant break down step 1

Case Study – QuadroLine+ArcoLine
Production process: Cant break down optimisation

**Active Curve Chipping with ArcoLine**

**Optimization Step 1**
Identification of the available space for the full length products
Case Study – QuadroLine+ArcoLine
Production process: Cant break down optimisation

Active Curve Chipping with ArcoLine

Optimization Step 2
Shifting combinations of full length products ... until the maximum sideboard recovery or value is determined

Identification of the maximum sideboard recovery by shifting the sawlines within the available space ... max. right side
Case Study – QuadroLine+ArcoLine
Production process: Cant break down optimisation

Identification of the maximum sideboard recovery by shifting the sawlines within the available space

Case Study – QuadroLine+ArcoLine
Production process: Cant break down optimisation

Identification of the maximum sideboard recovery by shifting the sawlines within the available space ... max. left side
Case Study – QuadroLine+ArcoLine
Production process: Cutting pattern examples
Active Curve Sawing with ArcoLine:
The complete sawing process after the ArcoLine-Chipper-Canter, with the 2nd QuadroLine bandsaw and the double arbor circular saw is carried out by copying the ARCO CURVE.
Case Study – QuadroLine+ArcoLine

Production process: Final cant resawing

Horizontal calibration of center core (bottom remain head) → Vertical calibration of center core → Resawing of center core

Typical cutting patterns for resawing:

Ripping (same size) → Ripping (2x - 3x thin board) → Core separation
Case Study – QuadroLine+ArcoLine
Production process: Final cant resawing

- Low maintenance strobe saws, no water, no babbitting
- Min. distance 18 mm between moving saws

A = 18 - 650mm
B = 18 - 180 mm
C = 18 - 120 mm
Amax. = 1450 mm
(tool changing position)

Case Study – QuadroLine+ArcoLine
Grade Edger „Optimes Golden Eye“

EWD - Edger Optimizer System
- Optimes Line

MICROTEC - „Golden Eye“ Scanner
- Geometrical board profile
- Trachoid effect
- Surface inspection with red and blue channel
Case Study – QuadroLine+ArcoLine
Grade Edger „Optimes Golden Eye”

- „Ripping” solution
- „Chopping” solution

Maximum scan rate 2009: 1200 Hz for 500 mm scan width or 4 mm at 300 m/min

Case Study – QuadroLine+ArcoLine
Grade Edger „Optimes Golden Eye”

- Production of 4 grades simultaneously with 2 4-saw edgers to 1 sorter infeed deck
  - „coding“ the board with visible or invisible fluorescent marks to be read in the sorting system
- Grade marker with inkjet heads
Future possibilities
for industrial pine mills related to internal log characteristics

To increase value recovery from plantation pine sawlogs,
with the value difference between core and outside core material:

→ detect
  - knotty core (NZ, Chile) or
  - low density juvenile wood (Australia)
→ and adapt the cutting pattern - at least for the cant.

**Solution:** Real density measurement with X-ray

- X-ray: single source =
  - single plane, no information on height

Tomolog: discrete tomography with 2 or 3 X-ray sources

Ref. Lecture of Mr. Sergio Guzman and Mr. Jeff Tumbleson at Scantech Conference 2006
Technically used X-ray applications in the lumber industry:

- Stress grading of dry lumber (boards) in Multisensor setup (like Microtec „GoldenEye“ x-ray with about 200 installations worldwide)

- Discrete tomography applications:
  - log scanning under bark
  - metal detector (scrapnels left from the wars in Europe)
  - log grading in log sorting of Skandinavian pine (typ. 2 sorts)

Practical usable X-ray radiation level limit the thickness to about 700 mm in European spruce and 500 mm in (wet green) Radiata, with new sensor technology 700 mm will be possible.

- Full Tomography (rotating X-ray like medical tomography):
  - wood research at FVA Freiburg (German Forest Research Institute)
Future possibilities for industrial pine mills related to internal log characteristics

TOMOLOG

The Multi-view System

TOMOLOG determines foreign material, number of growth-rings, diameter without bark, branch size/position, knottiness, internode length, and knotty core dimension and position by using the Multi-view approach.

TOMOLOG

Recognize and locate low density core (and knots inside core area)
Future possibilities for industrial pine mills related to internal log characteristics

**TOMOLOG**

Core of pruned pinus radiata

2 views taken from full tomography = view of 2-source Tomolog

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**MiCROTEC**

INNOVATING THE WOOD

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Future possibilities for industrial pine mills related to internal log characteristics

**MAXiCUT**

Cutting pattern optimization without knowing the low density core position

Cutting pattern optimization knowing the low density core position

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Future possibilities for industrial pine mills related to internal log characteristics

Maxicut

Breakdown Optimization - Comparison

(apply value relation 2.5 : 1)

<table>
<thead>
<tr>
<th>Optimization without knowing the knotty core position</th>
<th>Optimization knowing the knotty core position</th>
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<td>Pieces</td>
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+5% .... + 10% ?

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Future possibilities for industrial pine mills related to internal log characteristics

* For further reading:

**Effect of small changes in saw pattern on lumber value in pruned Douglas fir logs:**

**Steps towards greater value from pruned logs**

*Christine Todoroki and Eini Lowell*

NZ Forest Research Institute Ltd, Rotorua, New Zealand
Pacific Northwest Research Station, Portland, OR, United States of America

* Abstract:
Based on our research findings of value yield we conclude that:
1) Small changes in sawpatterns have a significant effect on lumber value
2) Selection of the cant size and position is critical to optimizing value yield
3) Volume optimization is not a good strategy when it comes to sawing pruned logs
4) Increased value can be extracted from a pruned log when the defect core is derived from intensive measures of the internal knotty core structure.

Thus a system that includes a non-destructive evaluation tool that scans the log for the internal knotty core, determines the defect core (DC), selects the appropriate cant size, and applies an optimization procedure to position the cant would yield significant benefits in terms of increased value.
Future possibilities
for industrial pine mills related to internal log characteristics

The resultant boards were graded into four categories:
a) knot-free;
b) knots on one face;
c) knotty both faces; and
d) knotty both faces with pith.

Board value was calculated relative to that of the highest valued lumber using weights:
1.0 knot-free grade, 0.85 knotty one face, 0.30 knotty both faces, and 0.25 knotty with pith.

Significant increases in yield were noted with the intensively measured DC, not only for the optimal value solution but also for the Best Core strategy.

The yield increases averaged 11 % and 5 % respectively, equivalent to $24/MBF ($1 0/m3) and $1 1/MBF ($5/m3) based on a price of US$840/MBF (us$356/m3) for knot-free lumber.

Date: 2006
www.treesearch.fs.fed.us/pubs/24530

Future possibilities for pine mills
Dead End or Future Chance?

1. Timber is the only really renewable CO2 neutral material.
2. Timber processing needs low energy without waste disposal problem.
3. Assigning the right products to raw material zones is the first but very efficient step to add value.
4. Customer-tailored products must have a better price.
5. Applying „HighTech“ to industrial log processing is the future way to go!
Thank you very much for your attention!