CIRCULAR SAW MONITORING SYSTEM

PRIMARY WOOD PRODUCTS MANUFACTURING

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SIMULATION OF A GUIDED SAW, SPEED RAMPING
SAW RUNNING AT CRITICAL SPEED
SAW CUTTING AT CRITICAL AND SUPERCRITICAL SPEEDS
MEASURING VIBRATIONS OF SAW AS SPEED RAMPS UP
DEFLECTION OF THE BLADE DURING SPEED RAMP UP
EFFECT OF HEAT ON DYNAMIC BEHAVIOUR OF SAW
EFFECT OF HEAT ON SAWING PERFORMANCE

HEAT RESULTS IN HIGH SAWING DEVIATION.
THE FEASIBILITY OF DEVELOPING A MONITORING SYSTEM FOR GUIDED CIRCULAR SAW
PRACTICAL LIMITATIONS FOR CIRCULAR SAW MONITORS
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Safe area for placing a sensor
CHOICE OF SENSORS

1. Displacement Sensor
2. Force Sensor
3. Accelerometer
4. Microphone
5. Acoustic Sensor
6. Deflection Sensor
7. Temperature Sensor
EXPERIMENTAL SETUP
SAW DEFLECTION BELOW THE GUIDE DOES NOT CORRELATE TO WHAT IS HAPPENING IN THE CUT ZONE.
FORCE AND VIBRATION SIGNALS ARE TOO NOISY TO INDICATE SAW DEFLECTION.
LAB TESTS INDICATED THAT THERE IS A CORRELATION BETWEEN CUT DEVIATION AND AE SIGNAL.
SAWMILL TEST CONFIRMED AE IS NOT SUITABLE FOR THIS APPLICATION.

Signal by AE can be affected by:

- Multiple saws work together
- Other mechanisms working simultaneously
NO DIRECT CORRELATION WITH CUT DEVIATION, BUT MACHINE LEARNING
TECHNIQUE CAN BE USED TO FIND PATTERNS BETWEEN GOOD AND BAD
SAWING PERFORMANCE.
DIRECT MEASUREMENT OF SAW DEFLECTION ABOVE THE CUT
DIRECT MEASUREMENT OF SAW DEFLECTION ABOVE THE CUT

- Accurately measures saw deflection in lab tests
- Limitations: Needs to be very close to the saw
IN SUMMARY:
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BLADE TEMPERATURE IS CRITICAL TO SAW STIFFNESS

1- Teeth Cutting
2- Dull Tips
3- Wood Movement
4- Guide Rubbing
5- Packed sawdust in the guide pocket
6- Slivers & Debris

3- Wood Movement
(results in wood leans against saw and creates friction)
MEASURING SAW TEMPERATURE

Wireless Temperature Sensor
BLADE TEMPERATURE IN A CUT

Temperature (°C) vs. Time (Sec.)
BLADE TEMPERATURE IN A CUT

Temperature (°C) vs Time (Sec.)

Sawing Start

Sawing End
BLADE TEMPERATURE IN A CUT

- Saw Heating
- Saw Cooling
- Idling
- Sawing Start
- Sawing End
BLADE TEMPERATURE IN A CUT

Temperature (°C)

-Time (Sec.)

- Sawing Start
- Saw Heating
- Sawing End
- Saw Cooling
- Idling
- ΔT: Temperature Change after Cut
- Δt: Time to cool down
BLADE TEMPERATURE IN A CUT

\[ T = T_\infty + \beta e^{-\gamma t} \]
BLADE TEMPERATURE IN A CUT

\[ T = T_\infty + \beta e^{-\gamma t} \]
APPLICATIONS OF THE TEMPERATURE DATA

• Warnings, perhaps before problems become critical

• Adjust amount of guide water

• Adjust gap between cuts to allow saw to cool

• Feed speed control is possible.
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✓ The temperature sensor can be used for some monitoring options, such as gap between cuts.

✓ The temperature sensor can indicate poor cutting conditions, and provide warning before it becomes critical.

✓ The temperature sensor can be used as a trouble-shooting tool.
GET IN TOUCH
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HOW TO EVALUATE CUTTING PERFORMANCE?
HOW TO EVALUATE CUTTING PERFORMANCE?
HOW TO QUANTIFY SENSORS DATA?
HOW TO QUANTIFY SENSORS DATA?