RESEARCH

MATERIAL HANDLING

Conveyor belt monitoring for wear detection

Pre-empting roller failure using fibre optics

Challenge

Conveyor maintenance is a significant daily problem for the mining industry. Conventional methods of detecting bearing failure in conveyor rollers are unreliable, time-consuming and labour intensive.

Overland conveyors of 5 km are commonplace and 20 km conveyors from a local mine truck dump pocket to the processing plant are becoming increasingly common. A typical conveyor can have up to 7,000 bearings per kilometre, which means 7,000 potential points of failure. There have been several attempts to speed up and reduce the cost of monitoring all the bearings along a conveyor, and yet the original method of "walking the belt" observing and listening to the sound is still the most commonly used approach.

Research

An improved and newly emerging solution by Mining3 is an automated roller failure detector using fibre optics. The new technology is capable of constantly monitoring an entire conveyor system and alerting operators offsite to potential failures before they happen.

This technology is capable of:

- Detecting a broken ball or a cracked cage in a ball race
- Observing idler bearings as they progressively wear and track the development
- Predict potential bearing seizure and advise maintenance crews to change a roller at the next shut-down

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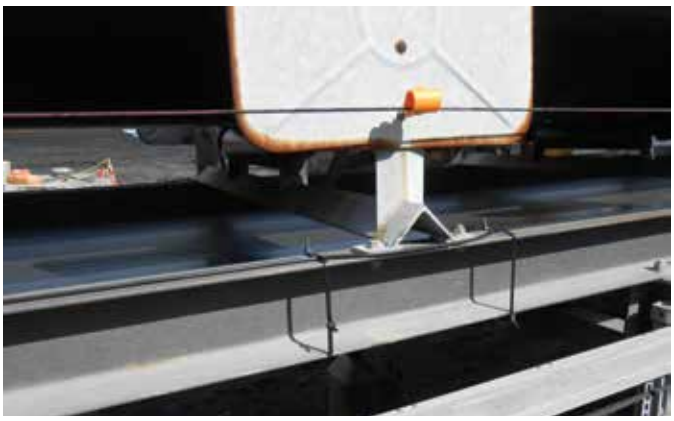
How it works

A fibre optic cable is run along the length of the belt with a single interrogator and analysis unit in a switch room.

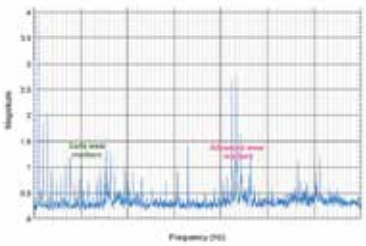


The fibre optic acoustics technology works by recording the Rayleigh backscatter from inside the glass fibre. A powerful and very short laser pulse is transmitted along the single mode fibre, so it travels directly down the centre of the glass. Microscopic imperfections in the glass scatter the light in the same way that the earth's atmosphere appears blue from sun light being backscattered on oxygen and nitrogen molecules in the atmosphere. As the fibre moves, the backscatter varies and this is captured by a sensitive light sensor, amplifier, and digital to analogue converter (DAC).

The pulse-repetition-frequency of the laser and the sampling frequency are adjustable for conveyor distance, discrimination between idler frames and clarity of signal. When it is correctly set up, the interrogator is so sensitive it can detect the sound of single raindrops hitting the fibre.

It gathers data from every metre of the conveyor simultaneously. Samples are collected for several minutes after which they are processed in software. In less than an hour, every section of the conveyor has its own frequency plot image.

The Mining3 solution generates a "heat map" of the whole conveyor which shows hotspots in yellow and red where bearing wear has been detected by the software. One kilometre of conveyor can be tested in 10 minutes, from an operation centre, by inspecting the heat map and frequency plots at the hotspots and identifying worn bearings.



Metric 1	Metric 2	Metric 3
30323258.07	30344942.09	30264534.58
28946430.6	28907699.02	28706009.15
35019000.71	35128258.68	34997345.15
40057311.37	39944942.25	39817561.78
40988329.1	40944544.53	40544287.88
33428666.72	33330808.86	33034630.54
35750848.1	36454144.84	35827231.22
36305846.29	46330972.71	34863655.81
79409671.28	122202873.5	59733827.86
95964249.7	158215802.5	66382830.21
[illegible]	[illegible]	[illegible]
133390749	270820709.8	63162964.14
49712912.59	70312508.15	36285585.89
33897686.42	34999082.6	32799792.12
32451760.67	32427257.26	32170918.49
33338778.78	33283845.46	33052574.55
34124818.66	33994390.69	34014547.52
34210541.51	34254641.45	34154041.78
31986054.55	31868627.63	31954809.37
31843159.31	31723232.39	31541996.85

Benefits

There can be little doubt that distributed fibre optic acoustic monitoring is the way of the future for monitoring bearing wear in idlers. The benefits include:

- Ideally timed roller change-out – not premature and not too late
- Reduced reliance on costly manual inspections
- Less subjective approach and more formalised
- Easy installation of the fibre optic cable and repair is as simple as re-joining the ends
- Monitoring of the conveyor can be from an operation centre anywhere
- Captured data can be used to keep records and optimise maintenance strategies
- Maintenance requests can be generated automatically and the data checked by an engineer in a remote location
- Increased safety of personnel by reduced manual involvement.

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About Mining3

Mining3 is the world's leading research organisation, directed by its global mining industry members to develop and deliver transformational technology to improve productivity, sustainability and safety.

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