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Anglais / STI2D enseignement transversal

Sujet n°8

Thème:

Solutions for railway bogie condition monitoring

Bogie condition monitoring offers new opportunities to increase reliability and safety and achieve lower maintenance costs. Incipient damage can be detected and mechanical failures prevented.

The railway industry is constantly looking for methods and technology to significantly reduce life-cycle cost (LCC) and total cost of ownership (TCO). For more than 150 years, even before the economic terms LCC and TCO where invented, fragmented reporting systems were used to help establish railway vehicles costs. Purchasing cost, coal consumption for steam locomotives, workshop man-hours per operating mileage and spare-part costs were some of the main indicators of efficient railway operation, although reporting was rarely consolidated.

From the beginnings of railway technology, there was always a strong focus on reliability and safety. Traditional on-the-spot repair was quickly replaced by maintenance schedules based on mileage and/or time. […]

[…]

1.1. Facts

Applying the knowledge and experience of the wind mill industry has added a number of possibilities to the railway industry. It employs the use of intelligent sensing technology for critical components coupled with communications tracking through a global positioning system. The result is a bogie condition monitoring system that supports extended maintenance intervals with safe and reliable train operation.

LESSONS FROM WIND POWER

There is a continuously increasing demand for reliability and safety as well as for maintenance cost reduction. Condition monitoring is a mature technology, and the railway industry has benefited from such advances. In other industries, such as wind power, for years maintenance schedules have been based on condition monitoring results. Wind farm operators take a proactive approach to maintenance, thereby reducing operating costs.

SKF WindCon data transmission, monitoring and management.

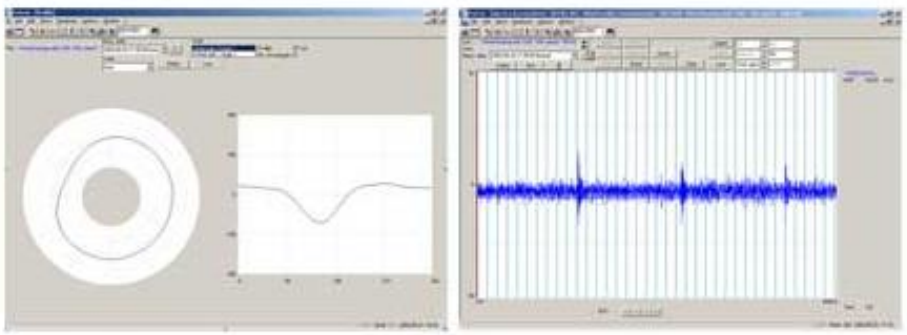
An online condition monitoring system enables the operator to monitor individual turbines and gearboxes or an entire wind farm in order to predict when maintenance will be necessary. SKF's WindCon online condition monitoring system collects and analyzes the mechanical data, compiles it and provides a reliable performance overview in order to identify incipient damage and predict possible failures before they occur. With this information it is possible to plan maintenance activities more effectively and to extend the time between costly offshore site visits.

[…]

RAILWAY CONDITION MONITORING

There are quite a few similarities between the basic reliability and maintenance requirements of wind turbines and railway vehicles, but there are significant differences as well. Wind turbines are stationary while railway vehicles are mobile, operating over vast areas and sometimes covering several countries.

This means not only different geographical locations, but also different technical requirements, and even the basic technical regulatory standards can be very different. The average life expectancy of railway rolling stock is also much longer than the life expectancy of a wind turbine, […]

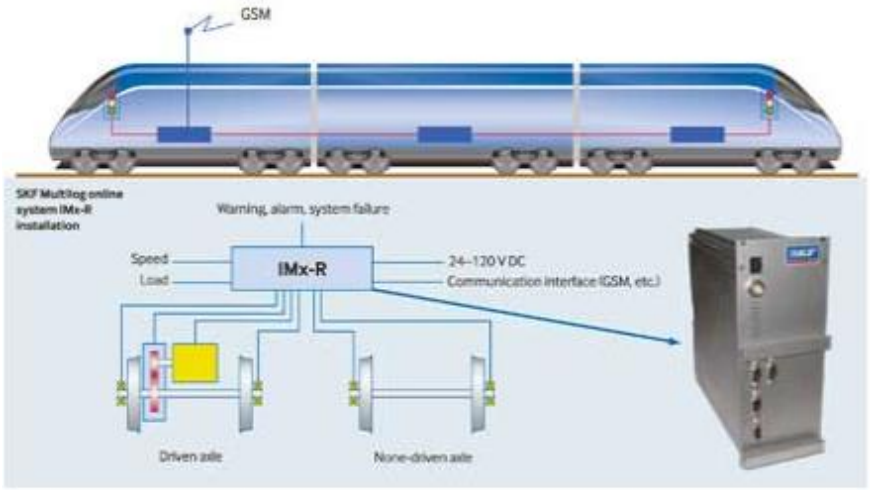


Wheel roundness and spectra.

[…]

Wheel set condition monitoring is implemented by a vibration sensor mounted on the axlebox housing, or integrated into the axlebox bearing, to provide information that can be used to determine the condition of the wheel set, such as wheel flats and wheel shape. The real-time calculation also uses information about the shaft speed. Wheel maintenance is very costly and time-consuming. With bogie condition-based maintenance, the timing of these operations can be scheduled by optimizing the operating mileage of wheel sets without any compromise to reliability and safety.

This system […] is able to detect a deterioration of the condition of the axlebox bearing by monitoring the temperature and/or its dynamic frequencies. The maintenance requirement is generated by the system, and the system indicates the need for operational restrictions when necessary, depending on the extent of the bearing damage. The detection system operates fully independently onboard the train, and the diagnosis messages are communicated to the driver.



SKF Multilog online system IMx-R installation

For decades axlebox bearings have been monitored in the railway industry by means of stationary trackside-mounted temperature- and noise-detection systems. This equipment is typically installed at certain intervals along the track or at strategic locations, such as ramps in the case of alpine railway lines. Such a system typically provides an indication of heavily worn or damaged components. As a result, the train must be stopped and the faulty wagon replaced and sent to the next suitable workshop. This causes operational delays and additional costs […]

GPS TRACK PROFILING

Information from the axlebox vibrations through the bogie condition monitoring system linked with a global positioning

system, GPS, facilitate profiling of the track sufficiently accurately to determine deterioration of the track as seen by the wheel sets over time. The system may accommodate any type of sensor, but principally vibration sensors are used.

Furthermore, the system collects, analyzes and compiles a range of operating data. The system provides a reliable performance overview that identifies incipient damage and predicts possible failures before they occur, enabling operators to consolidate maintenance activities and perform necessary inspection and repair work during planned stops. This also creates the possibility of extended maintenance intervals and less unexpected downtime and costs, which results in a longer bogie uptime. The collected data also enables root cause failure analysis, which facilitates the elimination of recurring problems and failures through equipment improvements and redesigns.

Using existing onboard vehicle information sources along with additional sensors to monitor operating parameters, maintenance cost, reliability and safety can be improved significantly, and the system may be installed on new vehicles or retrofitted. […]

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