Measuring Wheelsets

PROSE single measuring wheels PR003A/B mounted into the PROSE bogie MOB EV 09 during test runs between Montreux and Zweisimmen

Requirement

In running dynamics testing of railway vehicles in many cases the forces between wheel and rail have to be measured. This measurement requires special measuring wheelsets according to the state of the art which are produced for this purpose. In this case the measuring wheelset is the essential and at the same time the most complex sensor in the measurement environment. Thus the reliability and the precision of the measurement wheelsets are crucial for the success of the tests.

The PROSE measuring wheelset system ...

... consists of the instrumented wheelset, the signal transmission and the the measuring wheelset computer. The wheelset is instrumented with strain gauges to measure the deformation of the wheel. The amplification and signal transmission are placed in the axle, well-protected against mechanical impacts and electromagnetic disturbance. The signal transmission is realized optically as serial data stream.
The measuring wheelset computer finally calculates the forces between wheel and rail as well as other contact parameters from the deformation of the wheel.

Precision

By using full bridges of strain gauges, the measurement of bending strains in the wheel, the use of twisted cables, the perfectly shielded arrangement of the signal amplifier in the wheelset axle and the optical data transmission a measurement of the strains in the wheel with the highest possible precision is realized. A precision, which can not be achieved with other methods like the measurement of strains with single strain gauges. This accurate measurement of the deformation of the wheel is the basis for a precise measuring wheelset. Also important is the calculation method of the contact forces from those deformations. By using an algorithm, which was developed by PROSE (Patent pending) and by measuring the current rotation angle of the wheelset, inaccuracies like ripples on the signals or the influence of tractive or braking forces are fully compensated. Also inaccuracies in situations where high lateral forces occur, which are known from older systems, are avoided. The complete calculation of the contact forces is done based on the measured deformations and the rotational angle of the wheelset solely.

Reliability

All elements of the PROSE measuring wheelset system are well-proven and were used successfully in field-testing by several testing laboratories throughout Europe. The most-critical component of the system is the instrumented wheelset itself. Damages to the wiring or the strain gauges on the wheel can occur even if the best possible shielding is applied. This may lead to a complete failure of the measuring wheelset. In this case a possibility to repair the damage in a short period of time is required.

If a strain gauge is damaged and has to be replaced, this is in many cases even possible while the wheelset remains mounted in the vehicle. After the replacement of course a recalibration has to be done, which is also possible while the wheelset remains mounted to the vehicle.
A PROSE instrumented wheelset can thus quickly be repaired and the downtime can be minimized. The measurements can be continued after a short period of time, without the need of dismounting the wheelset or transfering it to a calibration stand.

Cost benefits by reusability

The complete signal amplification and transmission system as well as the measuring wheelset computer is fully reusable by the use of standardized parts. For the measurement of the contact forces on a new vehicle only the measuring wheelset has to be built newly. But it is also possible to reuse parts of the wheelset itself. Especially with the wheel-web measuring method it is possible to mount the wheels onto a new axle and to reuse them. Even a new calibration is not necessary in this case.

Field of Application

The PROSE measuring wheelset technology can be applied to all wheelset types – even on individual wheels and on trailed axles (including quill drives). Besides the wheel-web measurement method the so-called combined measuring method is used, in which also the bending strains on the axle are used to calculate the contact forces.

Procurement

Measuring wheelsets are individually crafted sensors. An industrial production and to keep standardized wheelsets in stock is usually possible for standardized running gears only. Thus measuring wheelsets are often on the critical path in a project. Therefore an early occupation with the topic „measuring wheelsets“ is necessary. We recommend our customers to order the raw wheelsets, which will be used for building the measuring wheelsets, together with the normal wheelsets needed for the project. By this the risk that the measuring wheelsets become the critical path of a project is kept low.

We would be glad to support you from the beginning in this process.

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