  - Couplant-free electromagnetic ultrasonic transducer | Ultrasonic transmitter/receiver
- Exchangeable computer unit for uninterrupted inspection operation
- Modern, cross-platform software
  - Browser-based application compatible with all common operating systems
  - Individual user accounts for test traceability
  - Wireless access to the application and documentation
- Cross-manufacturer 18V battery system for completely network-independent operation

Are you already familiar with our industry-standard services?

- Accredited testing laboratory in accordance with DIN EN ISO/IEC 17025 for various NDT methods
- Certificate of competence of the accredited laboratory to qualify and validate (new) nondestructive testing methods for industrial testing practice in the field of ultrasonic testing
- Rapid transfer to market readiness for qualified, standard-compliant use in industrial applications, both for new developments (in-house developments) or for adaptations
- Our associated quality management system is certified in accordance with DIN EN ISO 9001

Contact

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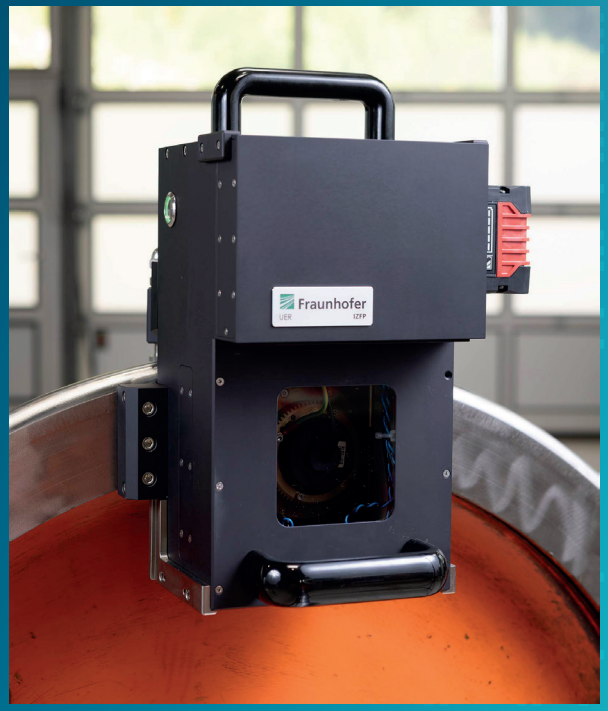
Fraunhofer IZFP

Sensor and Data Systems for Safety, Sustainability and Efficiency



Ultrasonic system for stress measurement in the rim of railroad wheels

UER

UER System on a mobile trolley

Left: Operation of UER-mobil; right: Result screen

UER – Ultrasonic system for stress measurement in the rim of railroad wheels

Break shoes used for braking freight car wheels are subject to continuously recurring heating and cooling processes that vary significantly depending on the braking conditions. These thermomechanical loads considerably change the residual stress state of the wheel rims over their service life. The thermally induced compressive residual stress state introduced during manufacturing gradually transforms into a circumferential tensile residual stress state. Small cracks – which are almost always present in the tread due to wheel–rail contact – can grow under the influence of sufficiently high tensile residual stresses and ultimately lead to wheel failure. This is why determining the residual stress state in the wheel rims is of particular importance.

To determine the residual stress state of a freight car wheel, UER uses the so-called acousto-elastic effect. This describes the influence of a given stress state on the propagation velocity of ultrasonic waves in solids. The magnitude of this effect depends directly on the propagation and polarization direction of the ultrasonic wave in relation to the direction of the stress. For residual stress measurement on freight car wheels, a linearly polarized shear wave is induced without a coupling agent by an electromagnetic acoustic transducer (EMAT) from the wheel rim side. During the measurement, the EMAT is moved along the wheel rim in radial direction in millimetre increments. At each position, two highly accurate time-of-flight measurements are performed, with the polarization direction of the shear wave being tangential and perpendicular to the running surface, respectively. Since residual stresses in the radial direction are not significantly influenced by the thermomechanical processes occurring during braking, the residual stresses in the circumferential direction can be determined from the difference between the two time-of-flight measurements, taking into account the material-specific acousto-elastic constant.

Numerous stationary and portable UER systems developed by Fraunhofer IZFP are in daily use worldwide at the workshops of railway companies, wheel manufacturers and maintenance service providers.

Applications

- Heavy maintenance
- Light maintenance
- Wheel production (DIN EN 13262)
- Wheel development

UER IV

- Decades of experience in industrial applications
- New, more efficient embedded system
- Fully network-independent operation
- Customer-friendly quick-change computer system to maximize availability
- Comprehensive on-site technical support provided by the Fraunhofer IZFP service team
- Maximum flexibility of connection to the IT infrastructure at the point of use
- Proven convenient and easy to learn operation

Technical features

- Complete integration of the inspection system into the manipulator
  - No permanent connection to a PC, laptop, or tablet is required for operation
- Fraunhofer IZFP's own compact ultrasonic technology
  - FPGA-based processing, amplification and filtering

