1.10.9. RESIDUAL STRESSES DETECTION IN ROLLING STOCK WHEELSETS BY MEANS OF ELECTROMAGNETIC ACOUSTIC METHOD

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According with management directive 32.144–2000 mechanical stresses assessment in the rim of solid-rolled wheels need inspect by means of ultrasonic shear waves *polarized* in radial and *circular* direction.

Using wheels with heightened *solidity* on railway transport make the outgoing inspection of stresses in the rim of railway solid wheels actual practical task. Contact ultrasonic methods for task exciting shear waves spreading along normal to surface in metals are laborious and unserviceable. Electromagnetic acoustic (EMA) method is used for exciting such wave's types in metals. Advantages of the EMA method are absence of mechanical contact between transducer and surface of test object, ability to use EMA method to excite shear polarized waves along normal direction to metal surface.

From non-linear acoustic laws it is known that ultrasonic wave velocity change is in proportion to value of tension and deformation in test object. Distribution of stresses in the rim of railway wheels is anisotropic that's why influence on propagation of shear waves with cross polarization will be different. Registration of bottom pulse coming time of shear ultrasonic waves with cross polarization allow to determinate value of residual stresses in rim railway wheels according with expression:

$$\sigma = D\left(\frac{t_{rad}}{t_{cir}} - 1\right),$$

where, t_{rad} – coming time of ultrasonic shear wave polarized in radial direction; t_{cir} – coming time of ultrasonic shear wave polarized in circular direction; D – acoustoelastic coefficient for steel of rim wheel.

Block diagram of *laboratory* installation is imaged on fig. 1.

Measurements have been made for wheel RU1 № 95206035-18329-05 in eight positions along *circle* of wheel. Set from free measurements has been executed for each position on wheel along radial direction with step 20 mm. Scheme of measurements is imaged on fig. 2.

Residual stresses have been calculated by value of time measurement and results are presented on distribution diagram of stresses along rim circle of wheel, fig. 3.

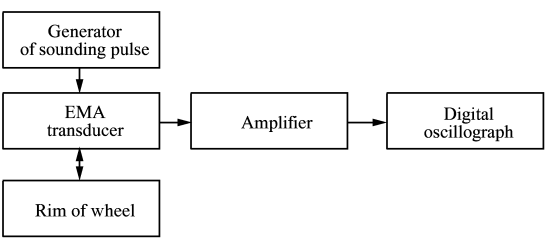

Fig.1. Block diagram of laboratory installation

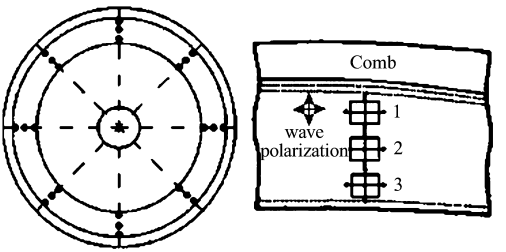

Fig. 2. Measurement scheme of rim's inside surface

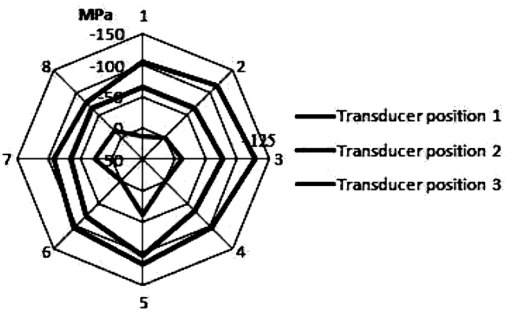

Fig. 3. Distribution diagram of stresses along rim of wheel

According with fig. 3 maximum of residual stresses corresponds to points located near of wheel comb, minimum value of stresses – in points located around fillet transition. Maximal detected value is –125 MPa. Calculated values of residual stresses belong to acceptable range.