Analysis of Defectoscopic Signals Using the Wavelet, Adapted to Detection Signals from Transverse Cracks in the Head of a Rail

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Abstract - Analysis of the signals obtained at magneto-dynamic flaw detection of the railway tracks by the continuous wavelet transform (CWT) using adapted to detection some defects wavelet is considered.

Keywords - CWT, transverse crack, adapted wavelet.

I. INTRODUCTION

The most important element of the railway tracks safety operation is the timely detection of defects that can lead to human victims and significant material costs. Currently, for high-speed diagnostics of the rails the most widely are used the ultrasonic (based on the ultrasonic nondestructive testing method) and magnetic (based on the magneto-dynamic method of nondestructive testing) wagons-defectoscopes which complement each other. In particular, magnetic defectoscopes better detects the transverse cracks in the head of a rail, which are especially dangerous because they can lead to cracking rails under the moving train [1]. It is on the identification of this defect, using modern tool of digital signal processing, such as CWT that will focus our attention.

II. JUSTIFICATION OF THE CHOICE OF TOOL FOR ANALYZING DEFECTOSCOPIC SIGNALS

The aim of research is to find possible ways to automate processing of the magnetic wagon-defectoscope signals by selecting information about the defects from these signals. It is for this that we need the CWT. In other words, CWT is a correlation of the "maternal" (basic) function at different scales with a signal, i.e., the more similar basic wavelet to the image (waveform from the defect), which is expected to find - the more precise (by the time axis ) and more correct (by the scale axis) it will be detected. It follows that the choice of basis function, which is essentially absent in other types of transforms, plays a major role in the analysis of the such signal characteristics that are most interesting for us.

III. RESEARCH RESULTS

Based on the waveform characteristics from the transverse crack and using the experimental data (Fig. 1,a) was created basic wavelet function adapted to detection of this defect (Fig. 1,b).

Fig.1. a) real waveform of the transverse crack; b) wavelet, adapted to detection of this defect.

By using this wavelet as a "maternal" was carried out the CWT of the defectoscopic signal fragment (obtained during the checking of region railway tracks Livy-Syanky-Chop, 11/06/2009) at which exists the image from the transverse crack with large enough amplitude. Result of the CWT is construction of scalogram [2] which displays values of the transform coefficients at different scales throughout the duration of the signal that is being analyzed. After analyzing aforementioned defectoscopic signal fragment and identical with a reduced signal from the defect (reduced to the minimum level at which it detects), in the place where was the transverse crack image, was built a vertical line with large values of the wavelet transform coefficients, which indicates the presence there local features.

IV. CONCLUSION

CWT is suitable for the detection both small and developed defects of the railway tracks, but only on condition that well-chosen the basic wavelet and optimally selected threshold values of the wavelet coefficients at certain scale according to which will be taken the decision about presence or absence of a particular defect.

REFERENCES