Application Of A Magnetic Field Model Above The Defect For Detection Of Transverse Cracks In The Magnetic Flaw Control Of The Railway

Vitalij Nichoga, Igor Storozh, Liubomyr Vashchyshyn

Abstract - **Method of signal analysis for magnetic flaw control of the railway is presented.**

Keywords – **Flaw detector, transverse crack, model, signal processing.**

I. INTRODUCTION

Diagnosis of technical condition of facilities ensures their safe operation and timely detection of defects. This is especially true in the diagnosis of objects, whose defects can cause considerable material losses or casualties. These objects include railroad rails. Timely detection of defective rails can take measures to prevent rail break under the train, which increases safety and economic efficiency of rail transport in general.

II. THEORETICAL PART

The goal is development of possible methods for automating the process of signal processing in magnetic flaw detector.

In [1] a study of the possibility of using a sample recorded signal on the transverse crack was described. To analyze the obtained magnetic defectogram wavelet-like transform was performed, in which the role of maternal functions the sample of the recorded signal was used. Sample signal was resampled (scaled) to form an array of signals that have been stretched or compressed relative to the original length. The ratio of new to the original length was 0.5 to 2. After this the fragment of defectogram was correlated with each of these signals. For the resulting two-dimensional array a correlation maximum was found in both dimensions: length of the defectogram and the scale of the sample signal. It was shown that the maximum is on the scale of 1:1 for both cracks and rail junctions, as junction and big crack have the same effect on the magnetic field in the rail. It was also shown that for signals from other objects, such as steel wire flattened on rail, the maximum is at other scales.

However, the real signal contains noise and other disturbance caused by surface defects near the crack, and is a special case with its own features, so use it as a basis is not sufficiently effective. High-quality recordings of transverse cracks occur very rarely. Therefore it was decided to create a model on which you can obtain a signal at the output sensor.

To solve the task, the model based on fictitious magnetic charges that formed the walls of the fracture [2]. The model was extended from one-dimensional to three-dimensional, making it possible to simulate the field from the crack of arbitrary shape in the space above the rail.

Vitalij Nichoga, Igor Storozh - Lviv Polytechnic National University , S. Bandery Str., 12, Lviv, 79013, UKRAINE, E-mail: nich@org.lviv.net
Liubomyr Vashchyshyn – Karpenko Physico-Mechanical Institute of the NAS of Ukraine, Naukova Str., 5, Lviv, 79601, UKRAINE

III. RESULTS OF RESEARCH

Waveform based on the model corresponds to the static field distribution. To take into account that when moving the flaw detector inductive sensor measures the change of the field the Hilbert transform was applied, which complements the signal with imaginary component (Fig1).

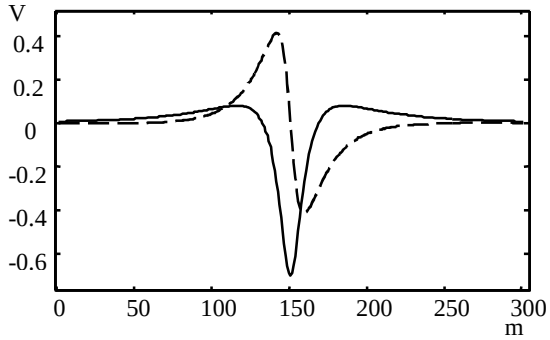

Fig.1. Simulated signal from the crack and its orthogonal complement (dotted line).

This form was resampled and the same procedure as described above was performed. It was defined the condition that the maximum should be at 1:1 scale and should not reach the level of correlation with junctions. To check the proposed model it was analyzed defectogram taken at region Lviv – Sianky – Chop with length of 78 km. 89 suspicious pulses was found, most of them correspond to welded junctions. In addition the developed program revealed the transverse crack at the 36th kilometer of railway, which was previously detected by operators.

IV. CONCLUSIONS

This method can be used to detect dangerous defects in railway tracks. Software implementation does not require large computational costs, allowing for signal processing in real time.

V. REFERENCES

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