

Havryliuk V. The Wavelet Based Detecting of the Signalling Relay Armature Defects //2019 IEEE 2nd Ukraine Conference on Electrical and Computer Engineering (UKRCON). – IEEE, 2019. – P. 507-512..

The Wavelet Based Detecting of the Signalling Relay Armature Defects

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Abstract— The paper discusses the problem of prompt detecting of the armature and contact springs defects in railway signalling relays. These relays used for safety-related applications in railway signalling systems should be properly maintained and monitored to ensure reliable and safely operation throughout their life. Most of the tests for signalling relays are performed manually, which is time consuming and very expensive. The method proposed in the paper is based on the digital wavelet packet transform and wavelet packet energy Shannon entropy analysis of transient currents in relay coil when it is turned on. In order to extract the features of relay defects the time dependences of the relays' transient currents during their switching have been measured. The investigations were performed with neutral signalling relays, some of which were correctly adjusted, and some had defects in the form of bent contact springs or defects in the coil or magnetic core. The transient current curve when the relay is turned on is conveniently to divide into three segments in accordance with the physical processes taking place. In the first and third segments, the armature does not move, and in the second segment, the armature and contact springs move from one position to another. The transient current of relay in the first and third segments increases in time approximately exponentially, and the time constants of the current variation in these segments can be used to prompt detect the defects of the relay coil and magnetic core. The features of the time dependence of the wavelet packet transform coefficients in the second segment of the transient current strongly depend on the armature defects and therefore they are effective for detection of the defects. The wavelet packet energy Shannon entropy of the relay transient current can be used for prompt detecting of armature and contact springs defects of the signalling relay.

Keywords— *signalling relay, wavelet transform, wavelet entropy*

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