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Detecting of Signal Distortions in Cab Signalling System Using ANFIS and WPESE

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***Abstract* — The problem considered in the work is concerned to detecting of signal distortions occurred in the railway ALSN cab signaling system. The ALSN system is designed to transmit track status information into the train cab and uses rails as a continuous communication channel between track and train. The amplitude and duration of the pulses in the ALSN code combinations are changed over time due to deterioration of the track transmitters and other devices in the signal transmission channel, as well as due to electromagnetic influence of the traction current, rails magnetization, and other sources of electromagnetic interference. Due to distortions of ALSN signals, their decoding becomes unstable, which leads to intermittent failures in the form of temporary incorrect indication at the cab traffic light or to complete failure of the ALSN system. Diagnostic of the ALSN system and the revealing of signals with distortions is carried out by analyzing the signal current, recorded using the railway car-laboratory. However, the use for this purpose the classifiers with sharp boundaries for input diagnostic parameters and strict rules for signal selection does not allow us to reveal incipient defects that arise in the ALSN system. The work investigates the effectiveness of using adaptive neuro-fuzzy inference system (ANFIS) and wavelet packet energy Shannon entropy (WPESE) for timely detecting of signal distortions in the ALSN system. The obtained results confirmed the efficiency of ALSN signal processing using ANFIS and WPESE for detecting of railway sections with unstable or faulty ALSN system.**

Keywords— fault detection, cab signalling system, signal disturbances, wavelet transform, adaptive neuro-fuzzy inference system

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