

ANFIS Based Detecting of Signal Disturbances in Audio Frequency Track Circuits

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Abstract— The problem considered in the work is concerned to monitoring of signal disturbances occurred in the audio frequency track circuits (AFTC). Track circuits are designed to detect the presence or absence of a train in a particular section of the rail track, and therefore, they are main and safety critical components of an automatic train control systems. Deterioration of the AFTC components appeared during their operation, as well as electromagnetic interference and adverse weather conditions can significantly change the signal current parameters, which can lead to dangerous situations for train movement. To ensure safety of railway signalling system, it is necessary to use an automatic diagnostic system that allows timely detection of appearance of significant disturbances in AFTC signal. The use for this purpose the classifiers with sharp boundaries for input diagnostic parameters and strict rules for signal classification does not allows 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 disturbances in audio frequency track circuits. The obtained results confirmed the efficiency of AFTC signal processing using ANFIS and WPESE for detecting of railway sections with unstable or faulty track circuits operation.

Keywords— *track circuits, wavelet transform, wavelet entropy, adaptive neuro-fuzzy inference system*

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