1.10.38. AUTOMATION OF PROCESSING AND DECODING OF RESULTS OF ULTRASONIC FLAW DETECTION IN RAILS

Zaika S.I., Lonchak V.A., Marandich D.M.,
Scientific and Production Enterprise "RDM", Kishinev, Moldova

Main flaw-featuring parameters are defined basing on the analysis of recording and decoding methods for the results of rail testing by mobile and removable flaw detection means. Software for recorded data processing is elaborated; it permits screening out of disturbing signals and improving of reliability of flaw detection, determination of flaw type and dimensions.

Existed requirements to the trustworthiness of ultrasonic flaw detection in rails put forward the task of objectification of testing results. It is achieved by application of modern flaw detectors with data recording, processing and memorization.

Naturally, in dataflow recorded by receivers of flaw detection complex, interfering signals from various reflectors being not dangerous defects, as well as signals of acoustic and electric noises are recorded in addition to valid signals from so called "regular reflectors" (rail joint gap, bolt holes in a web). False signals of noises occur in the result of imperfection of tracing systems, bad state of rail track, deterioration of rail surface and non-homogeneity of metal structure. Recording of interfering signals complicates significantly the decoding of test results and can result in omission of dangerous defects.

Usually, rails are tested with search (recording) sensitivity. While during decoding, either this sensitivity is reduced to the rejection level specified by respective instructions or the selection threshold is modified. However, the practice of ultrasonic flaw detection shows that false reflections and electric noises exceed, as a rule, by amplitude signals from a defect. Therefore, when one attempts to clear defectogram by modification of recording threshold, it is cleared also of intelligence signals on defects.

Analysis of the main parameters of flaw-featuring signals and systems of their recording has shown that determination of the minimal conventional length and/or height of reflector, as well as of increment of the echo-signal arrival time in subsequent periods are the most efficient processing methods.

Minimal conventional length of a defect to be detected defines the number of synchronous pulses (K) within the group of N possible ones. Dependence between them is defined by the known expression for "serial" criterion:

$$K = 1.5\sqrt{N}.$$

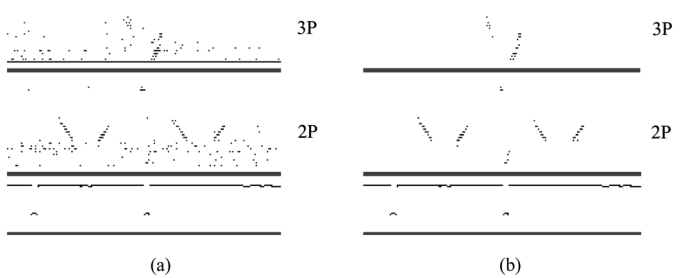

Fig. 1. Record of a parched transversal crack in a railhead (3P channel):
(a) Regular record; (b) Processed according to the "production" criterion

During movement of searching system, the time of USO (ultrasonic oscillations) propagation to reflector and then back from it will increase for zooming-in angle resonator and decrease for zooming-out one. These signals are recorded on the B-sweep (recording in "USO propagation time – passed distance" coordinates) in the form of inclined lines with slope for single-type reflectors depending only on the probe entry angle. Should USO are emitted (or recorded and memorized) into a rail through equal sections of passed distance Δl, propagation time to resonator and back from it with every subsequent pulsing decreases for zooming-in resonator and increases for zooming-out resonator by just the same value Δt.

Disclosed method for processing and decoding of test results is implemented in hardware-software complexes for railway rails diagnostics. For operator, it is enough to activate the selected option (to set conventional length or height of supposed defect) and coordinates of railway sections with reflectors corresponding with such criteria will be displayed on the computer's monitor. These sections are subjected to further analysis to screen out "regular" and false reflections in order to take a decision on the presence of a defect.