ASSESSMENT OF INTERROGATION TIME FOR ANALOG SIGNALS DURING TROUBLESHOOTING OF RAILWAY AUTOMATICS AND TELEMECHANICS DEVICES

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The control of operability of railway facilities and structures presupposes exploitation of systems based on modern hardware and software tools. The fact, that those systems in different countries are based on divers concepts and operation algorithms, doesn't affect the task of upgrading of hardware and software of control subsystems used to achieve processing speed and validity in order to identify symptoms (values), preceding failures.

Source information on conditions of different elements and units is received from diagnostic sensors or detectors. Every separate standard operation of data processing can be realized by different methods and, consequently, with different algorithms.

The unit of analog control, transforming analog value into digital data, is one of the core elements of control system. The most accurate algorithms of such units occupy large memory volume and have a prolonged execution time.

High sample rate causes control system sophistication and the excessive load on computing part of microcontroller. Low sample rate risks to make interrogation pointless.

The study of methods and techniques of determination of the interrogation time of analog signals is followed by extension of some new techniques intended to ensure the required accuracy of measurement, quality of received data, and validity of checking of effective values.

The process of uploading of information on permanently changing rates into the microcontroller is discrete in terms of time, so there is a task to restore the values of measured rates at instants of time, which do not coincide with the instants of measuring.

The data reconstruction process is usually based on different interpolation techniques while the accuracy is limited by quantization error. In conformity to Kotelnikov-Shannon theorem the exact reconstruction is possible only if analog signal x (t) has a limited spectrum.

The required accuracy of definition of interrogation value on analog-digital transformations is deemed to be achieved without having recourse to special extrapolation algorithms but by step extrapolation. Besides, thanks to that approach computing unit loading by data processing is considerably reduced.

Assessment of unknown period of interrogation of analog systems supposes computing of interrogation period by step extrapolation for every meaningful measured value.

Let standard error of x (t) value definition equal to $\sigma_{\Delta x max}$, i. e. random component of sensor and step extrapolation errors. The problem is to find under those conditions a time slot between adjacent measurements, so that measurement, error should not exceed its prescribed value.

In order to proceed with initial computation of unknown time slot, an experimental measuring was held during which series of measurements were taken. Each value was measured 30–50 times with arbitrary time slots between adjacent measurements h_0. The expanded process of further handling of results is shown in table 1 and in the text.

Practical implementation of the research can result in prolongation of time between measurements (i. e. for a signal of 220V and 50Hz to 1 ms, and for a signal of 110V and 25Hz to 1,5 ms), and consequently in making requirements for automatics and telemechanics troubleshooting hardware more ease.

Key words: railways, troubleshooting and control system, interpolated values, sampling rate of analog signals, algorithms of recovery of shape and value of the measured signals, determination of the effective value of the analog signal.

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