ABSTRACT

The influence of selected environmental factors on railway traffic control systems functionality.

The main objective of this study was developing a method for improving reliability by stabilising the temperature of electronic control systems using a Peltier module. In order to that a dedicated research prototype was built which helped to determine a range of environmental parameters changes and their impact on electronic systems operations (operating parameters, reliability).

The analysis of a knowledge state and implementation of the study's goals allowed the author to formulate a following scientific thesis: "It is possible to increase the reliability of electronic control systems in transport by stabilising selected environmental parameters".

This study includes theoretical analyses, simulation and laboratory tests on Peltier modules, the influence of temperature change and humidity on electronic systems in a railway traffic control (SRK) cabinet. The analysis was used to estimate the increase or decrease of electronic devices failure occurrences in the control module of telematics systems which are used in rail transport. This study uses the reliability analysis as a method of simulating rare, random events which have a negative impact on remaining components in a railway traffic control (SRK) cabinet functioning. The MTTF (Mean Team To Failure) index was taken into account as a main factor and its impact on the reliability of the entire system.

The presented results of the simulation research shows that the analysed formulated methods describing number of failure occurrences are ineffective due to temperature change in a random manner and it is hard to define what weather conditions will be in analysed period of railway traffic control (SRK) cabinet. One way to solve this issue might be using more complex probability distributions to generate a random sample.

The study attempts to indicate a probability of failures in technical system elements using a mathematical (semi-Markov) model. The application of semi-Markov processes theory to describe the reliability of complex technical systems in traffic control allows to distinguish basic elements of the system which are most likely to fail.

The results of this study indicates practical usage of Peltier module, because it increases the durability of electrical components included in a railway traffic control (SRK) cabinet significantly. This translates into the efficiency of the entire railway vehicles traffic control system.

03.02.2021 r.
Emil Sodański