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## Abstract of the doctoral dissertation:
# „Using a genetic algorithm for selection of overvoltage unit components of communication interface in trackside equipment”

The dissertation, "Using a genetic algorithm for selection of overvoltage unit components of communication interface in trackside equipment" is devoted to the development of an author's method (GACSOP) for increasing the immunity of the digital communication interface (CAN bus) of trackside equipment (e.g. wheel detector) to surge voltage disturbances as defined in EN 50121-4.

The presented analysis of literature showed that the issue of verification of parameters of surge arresters that were used in industrial applications was discussed in only a few publications. It was found that there was no satisfactory knowledge concerning the testing and verification of parameters of critical elements of surge arresters. This gap can be filled using the proposed method that is based on a genetic algorithm, which aims to improve the immunity to high-energy disturbances and thus increase the reliability and availability of critical parts of the railway infrastructure.

The proposed method aims to select the components of a surge arrester from a defined component domain and create a specification that meets the assumed design requirements to ensure a high protection of critical railway signalling equipment against surge voltages. The selection of a test case is presented. The methodology of designing of the goal function and a detailed description of the determination of the penalty factor is described. The goal function is used to verify the quality of the selected surge arrester components by a genetic algorithm (GA). An original solution is also proposed to manage the risk of damage to a minor module of the device in order to minimise losses in case of abnormal disturbances. The study is complemented by a hypothetical case in which, based on simulation results involving smaller exposures, a modified specification of the surge arrester is proposed that enables energy dissipation with 66% higher amplitude of the surge voltage.

Connection cables are an integral part of wheel detectors. For the purpose of the dissertation a model with a four-wire power and communication cable was developed and functions were determined to approximate the degradation of cable parameters under the influence of external insulator damage using brine. This function will be used to select a method for verifying the condition of the cabling on sites.

On the basis of the analyses made, it was concluded that the specification of the surge arrester proposed by the genetic algorithm met the design expectations and the procedure itself enabled easy adaptation to include new assumptions that might arise during the research and development process or product maintenance. Therefore, the proposed GACSOP method makes it possible to improve the quality of the products offered and will increase the availability of the railway infrastructure.