ABSTRACTS of Ph.D. THESES

Selected abstracts of Ph.D. theses submitted at Russian transport universities and research institutions
For the Russian text please see p. 310.

Belousov, S. V. Methods and algorithms for troubleshooting switches with alternating current electric motors *[Metody i algoritmy diagnostiki neispravnostei strelok s elektrodvigatelyami peremennogo toka].* **Abstract of Ph.D. (Eng) thesis. St. Petersburg, PSTU publ., 2019, 16 p.**

Criteria have been determined that allow, without loss of signs of faults, to reduce the amount of information needed to test switches with AC motors.

Methods for troubleshooting switches with AC motors based on the theory of neural networks have been developed.

An algorithm for expanding the training sample is proposed, the use of which increases the speed of training of the neural network.

Methods for the logical analysis of the power function of the setting of switches have been developed.

The methods of selection of informative zones of operation of the switch actuator on the graph of the power function of the setting of the switch have been proposed.

The methods of the theory of neural networks and logical analysis have been synthesized into an integrated diagnostic method for switches with AC motors according to the power function of setting of switches.

Specialty 05.13.06 — Automation and management of technological processes and production (transport). The work was performed at Emperor Alexander I St. Petersburg State Transport University.

Makarov, A. V. Automated diagnostics of fastenings of a continuous welded rail track *[Avtomatizirovannaya diagnostika skreplenii besstykovogo puti].* **Abstract of Ph.D. (Eng) thesis. Moscow, JSC VNIIZhT, 2019, 16 p.**

The functions of changes of coefficients characterizing the type of intermediate rail fastening, the degree of pressing by rail fastening of a rail against the rail base and the fastener tightening torque, allowing to develop a method for automated diagnostics of the condition of fastenings, are determined.

The functional dependence of the value of tightening of the fasteners of intermediate rail fastenings on the magnitude of deformation of the fastening elements has been established.

The coefficients of change in stability of a continuous welded rail track under the action of temperature forces, which characterize the influence of the degree of rail pressure on the rail base, depending on the magnitude of deformation of fastenings and the torque of tightening, have been determined.

The changes in deformation values of different intermediate rail fastenings have been determined depending on the applied vertical load.

Specialty 05.22.06 — Railway track, survey and design of railways. The work was performed at Joint Stock Company «Railway Research Institute».

Prourzin, O. V. Model for calculating reliability of dual-channel systems with redundancy based on alternating restoration processes *[Model rascheta nadezhnosti dvukhkanalnykh system s rezervirovaniem na osnove alterniruyushchikh protsessov vosstanovleniya].* **Abstract of Ph.D. (Eng) thesis. Moscow, PSTU publ., 2019, 16 p.**

The controllable parameters of warranty periods for operation of its elements are introduced for a two-channel system with redundancy. The problem of optimal selection of these parameters in order to improve reliability and efficiency of the system is solved. The optimal algorithm from the point of view of machine resources saving, for constructing the lines of the level of functions from two arguments, which is used for graphical analysis of complex functions, has been substantiated and implemented.

The obtained scientific and methodological apparatus will allow one to calculate and analyze the reliability indices of a dual-channel system with redundancy, which has non-exponential distributions of repair time and uptime of each channel.

Specialty 05.13.18 — Mathematical simulation, numerical methods and program complexes. The work was performed at Emperor Alexander I St. Petersburg State Transport University.

Shishkina, I.V. Increasing the resource of turnout switches by improving fastening of switch rail elements to the base *[Povyshenie resursa strelok strelochnykh perevodov za schet usovershenstvovaniya prikrepleniya relsovykh elementov strelki k osnovaniyu].* **Abstract of Ph.D. (Eng) thesis. Moscow, RUT publ., 2019, 24 p.**

In the course of the study, experimental and theoretical developments were carried out for the first time to study the influence of design of fastenings of the switch points on their resource.

Comparative results of dynamic strength tests of pads of various design to determine their stress-strain state under the influence of trains, taking into account the features of different manufacturing techniques, were obtained.

The analysis of the service life of the elements of fastening of stock rails and points to the base is presented.

A probabilistic model of operation of metal pads of turnout points was constructed, which complies with the results of test operation, which allows one to calculate distribution of failures of pads depending on characteristics of metal from which they are made, on the initial tightening of fastenings and the stress spectrum generated by train load.

The dependencies of the failures of pads were obtained using the developed technique, which makes it possible to plan replacement of pads on turnout switches when changing the main metal parts.

The study revealed new types of defects that cause failures of pads.

To identify the causes of breaks of pads chemical analysis and metallographic studies of pads in the fractured sections were carried out.

Specialty 05.22.06 — Railway track, survey and design of railways. The work was performed at Russian University of Transport.

Supchinsky, O. P. Improving efficiency of managing the technical condition of mainline locomotives *[Povyshenie effektivnosti upravleniya tekhnicheskim sostoyaniem magistralnykh lokomotivov]*. **Abstract of Ph.D. (Eng) thesis. Omsk, OSTU publ., 2019, 20 p.**

A method has been developed for managing the repair process of locomotives using network planning to monitor and adjust implementation of technological operations.

An algorithm is proposed for determining the necessary transitional equipment, spare parts and materials to ensure high-quality implementation of technological processes for repairing locomotives of new series and consumption rates of materials for unplanned repairs, taking into account likelihood of operation failure.

A method has been developed for determining the energy efficiency index of an electric locomotive for monitoring and controlling of quality of technological repair processes and for assessment of efficiency of operation of main electric locomotives based on predicting additional power losses in nodes and assemblies that limit their performance as a result of the repair performed.

Specialty 05.22.07 — Rolling stock of railways, train traction and electrification. The work was performed at Omsk State Transport University.

Zavalishin, O. I. Methods to improve integrity and continuity of navigation data during precision approach landing of aircrafts using satellite radio navigation systems *[Metody povysheniya tselostnosti i nepreryvnosti navigatsionnykh dannykh pri tochnom zakhode na posadku po priboram vozdushnykh sudov s ispolzovaniem sputnikovykh radionavigatsionnykh sistem]*. **Abstract of Ph.D. (Eng) thesis. Moscow, MSTU CA, 2019, 22 p.**

A quantitative systematic analysis of the negative impact factors on SRNS signals and ways to improve integrity and continuity of navigation support of aircraft in the airfield area and during an instrumental landing approach using the differential mode of GNSS in the ICAO standard format (SARPs), as well as integration of radio engineering and optics (of various physical nature) in order to provide the ICAO-required navigation characteristics in the presence of radio interference and SMU (fog, clouds and others), have been suggested.

The proposed methods for meeting the requirements of the ICAO GNSS signal formed the basis for creation of the world and national Russian ever first software and hardware satellite navigation system and for the automatic precision landing approach using two GLONASS/GPS satellite systems for all types of airfields and heliports (polar, mountain, ice and others) compliant with ICAO standards.

Together with the classical differential corrections, defined as the difference between the calculated and measured pseudoranges, the paper proposed a method for estimating the errors in formation of these corrections for each satellite and transmission of B-values and other parameters containing information on accuracy and integrity of the differential corrections to the aircraft, which allowed to satisfy ICAO requirements for integrity of the GNSS signal and to implement in the on-board satellite landing equipment a calculation of the levels of protection, allowing a significant increase in the measure of confidence and continuity of determination of coordinates of aircraft, especially in the presence of noise interference and ionospheric storms in the vicinity of the aerodrome.

In order to improve integrity of GNSS signals in space, the paper proposes a method for estimating satellite data (DQM) and quality of signals (SQM) transmitted from satellites, which precedes the stage of calculating the differential corrections to pseudorange. This solution allowed to virtually eliminate the possibility of using unreliable onboard satellite navigation data when determining the coordinates in the differential mode.

The proposed new method for assessing quality of the satellite navigation signal provides not only protection against three pseudo-random sequence distortion models (A, B, C) offered by ICAO, but also protection of measurement data from any other forms of signal distortion in real time.

Specialty 05.22.13 — Navigation and air traffic control. The work was performed at Moscow State Technical University of Civil Aviation. ●