

*Stanisław Guzowski, Maciej Michnej: **Dimensional Analysis in Wear of Wheelsets Model Studies** (Analiza wymiarowa w badaniach modelowych zużycia zestawów kołowych)*

The notion of fretting comprises the effects of complex phenomena actions on the surfaces pressed against each other and loaded by a variable force of the elements. At present mechanical engineers agree that fretting is a phenomenon of a very complex wear mechanism, in which there overlap or follow in succession: adhesive wear, surface fatigue, exfoliation, oxidation, irregularities apex wear and loose products wear. The present query of periodicals dealing with the above subject, especially *Wear* or *International Tribology*, shows that the fretting wear problem is mainly considered in the aspect of the influence of material selection or technological process on the initiation of wear in the tribological node. There are no publications on the studies of fretting wear development mechanism in actual nodes of machines or vehicles. Carrying out tests on a real object such as a wheelset is very difficult. Fretting wear studies of a connection a wheel – a wheelset axle, in agreement with Heinke's classification of experimental tests, can be carried out as model tests on simple specimens when simulating real exploitation conditions. The advantage of such studies is first of all: a simple construction of a sample, easy selection of a typical stand for fretting wear tests, a significant shortening of the testing time, the possibility of detailed evaluation of wear in the connection area by making use of, among others, metallographic and metrological tests, lowering the costs of making the connection model and the tests themselves. On the other hand the disadvantage is the necessity of the achieved results verification with those carried out on a real object..

Keywords: fretting wear, railway wheelset, simulation, dimensional analysis

*Marianna Jacyna , Dariusz Pyza: **The role of intermodal terminals in the rail-road transport** (Rola intermodalnych terminali przeladunkowych w przewozach kolejowo-drogowych)*

The article presents the problem of transshipment terminals and their importance in the development of intermodal transport. The functions and tasks provided by intermodal terminals as well as their infrastructure elements were pointed out. Article characterizes the European Union action in the field of sustainable transport, focused on the development of low emission transport and environment pollution. Also the intermodal transport and its development over the last five years against the rail transport market in Poland were analyzed. More over the possibilities of cargo handling in intermodal terminals were identified.

Keywords: intermodal technologies, intermodal terminals, intermodal terminals' infrastructure

*Aleksandr Aleksandrovič Matusevič: **Mathematical Model of Integral Index of the Loss of Resources of Power Electric Equipment of Traction Substation in Operation***

(Математическая модель интегрального показателя потери ресурса силового электрооборудования тяговых подстанций в условиях эксплуатации)

The theoretical basis and methodological support solution of actual scientific and technical problems of the quality and efficiency of maintenance and repair is formed and further developed by providing an assessment the resource power electric of traction substations of railways in operation. Methods of forecasting of a residual resource are improved. They allow making scientifically based conclusions about the possible timing of the extension of operation of power electric of traction substations and thus providing a reasonable frequency and amount of recovery of wear throughout the life cycle, and reduce operating costs through the use of service based on the actual technical state. The parameter a technical resource is viewed as an integral quantitative characteristic of the actual state of the electrical equipment. The mathematical model for evaluating operation of electrical power resource, taking into account its operation modes is developed. Calculation of the expense of the resource transformer for different temperature operating conditions when exposed to operational factors is done.

Keywords: power supply, traction substation, power supply equipment, maintenance and repair, actual resource, actual working resource, residual resource, mathematical model, integrated indicator of resource estimation

*Norbert Radek: **Laser welding of steel used for transport means** (Spawanie laserowe stali stosowanych w środkach transportu)*

In the paper the tests of the impact of the selected parameters of laser welding on the mechanical properties of the weld have been presented. The influence of two parameters have been analyzed: moving speed and beam intensity. The research of the properties of the weld and neighboring zones comprised the following measurements: tensile testing, hardness and microscopic observations. Welding was done with CO₂ TRUMPF, Lasercell 1005 model (wave length $\lambda=10,6 \mu\text{m}$). The samples were produced from DC04 steel of 0,8 mm thickness. Tensile testing was conducted on the tensile and compressive strength testing device LabTest 5.20SP1. Hardness was measured with NEXUS 4304 tester. Microscopic observations were carried out with the scanning microscope Joel type JSM-5400. The performed tests indicate that welds produced at different welding parameters have similar mechanical properties.

Keywords: laser welding, weld, mechanical properties, transportation

*Jan Radosz, Dariusz Pleban: **Acoustics of Railway Control Centers Based on Selected Rooms** (Akustyka posterunków nastawczych na przykładzie wybranych pomieszczeń)*

The article discusses the issues of acoustics in railway control centres. Acoustic parameters used to assess this type of premises are presented and their recommended values based on national and international standards are given. The article also discusses the results of noise and room acoustics measurements in selected centres and subjective assessment of noise by employees. The measurement results showed that both noise and acoustic properties of the rooms in most cases meet the requirements specified in the standards. However, the study indicates high levels of background noise. Only in two of tested control centres background noise levels were within the recommended range. Although survey results indicating a nuisance of noise in the work environment, there was no statistically significant correlation between the acoustic measurements and subjective assessment of noise nuisance.

Keywords: noise, room acoustics, work station, control centre, railway

*Artur Rojek: **Switching -off Time of Electromagnetic Blow-out High-speed DC Circuit Breaker** (Czasy wyłączania magnetowdmuchowych wyłączników szybkich prądu stałego)*

The high-speed circuit breakers are an essential safeguard against the flow of an excessive current in the circuit overhead line and vehicles being powered by it. The short circuit currents must be switched off as soon as possible to minimize the risk of damage, protected by circuit breakers, elements of an electric traction power supply system. The switching-off time is one of the main parameters of high-speed circuit-breaker. This time is specified from moment of exceeding of the circuit breaker tripping level by the current until cut off the current. The scope of high-speed DC circuit breakers tests for compliance with standards includes determining this time only for large currents, greatly exceeding the operating currents, and the currents of the very small – critical currents. However, during exploitation of high-speed circuit-breakers many faults clearance occurs by distant short-circuits or overloads. In order to determine the actual switching times of currents, which values are comparable with the tripping level researches and tests were performed for different values of the time constant, which were base of specifying value of arcing and opening time, depending on the value of breaking currents. The study involved electromagnetic blow-out high-speed DC circuit breaker BWS type, which is the most common breaker in traction substations and sectioning cabins in Poland.

Keywords: high-speed circuit-breaker, short-circuit, opening time, arcing time

*Michał Urbaniak, Marianna Jacyna: **Some Aspects of Multi-criteria Optimization of Rail Traffic Organization in Terms of Minimizing Costs** (Wybrane zagadnienia wielokryterialnej optymalizacji ruchu kolejowego w aspekcie minimalizacji kosztów)*

In the article the division of costs (internal and external) in rail transport was presented. In terms of external costs attention to the „attractiveness” of rail transport in relation to other modes of transport was paid. Moreover, was found that the multi-criteria optimization of the organization of movement of trains can also significantly reduce energy consumption and thus the costs generated by it. Achieving this is possible without incurring additional expenditure on infrastructure and specialized equipment. The examples of energy efficient solutions in this subject applying the optimal strategy for carrying vehicles (eco-driving) or energy recovery system. As part of the multi-criteria optimization of train traffic distinction criterion of efficiency recovered in the energy system of the vehicle – vehicle and the criterion of minimum energy consumption traction during transit was proposed.

Keywords: railway transport, multi-criteria optimization, cost of transport, energy consumption