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IN THIS ISSUE

Editor's

Andrzej Chudzikiewicz
Chairman of the Scientific Council IK

The Scientific Council of the Railway Research Institute at its first meeting of the new term of office held on 26 January 2017 appointed me its Chairman. Being grateful for the trust they placed in me, I would like to outline tasks that the Council is to carry out in the structure of the Institute. As one of the Institute's bodies, it acts basing on the provisions of the Law of research institutes and in the Regulations of Scientific Council. In accordance with the terms, the Council is a decision-making, initiative-taking, consultative and advisory body in the scope of its statutory activity and in matters relating to scientific, research and technical staff development. The Council performs multiple tasks set out in the Law. However, I would like to focus on two, which in my view, are essential. The first one is to give opinions concerning the directions of topics for research and development papers and work, the Institute's financial plans, the Director's annual reports on tasks conclusion and finally approval for prospective orientation of research, development and implementation activity. Although the Council's initiative-taking tasks as regards the staff development and direction of research are not envisaged in the Law *in extenso*, I believe that the Council's activity in these fields in the current term should become its priority. All activities should be conducted together with the Directors of the Institute to ensure synergy in the Institute's development. I hope that we will be able to unite efforts of the Council and the Director of the Institute in our work for further railway development in Poland.

Cyclic Scientific-Technical Seminars Held in 2016

In 2016, the Railway Research Institute, within the framework of monthly scientific – technical seminars, organized two meetings (13.09.2016, 13.12.2016) which focused on High Speed Rail (HSR) problems in Poland in the context of international experience and cooperation with the UIC. The six speeches concentrated mainly on technical and operational issues. The HSR construction requires heavy investments, whereas the profitability of this system is mostly determined by volume of passenger and freight traffic. Therefore having reliable and accurate traffic volume forecasts is particularly important. There is a possibility to improve the financial results on less congested lines due to the concurrent introduction of high speed regional traffic. The seminars brought together many participants, including representatives of government administration, such as the Ministry of Infrastructure and Construction, the Office of Rail Transport, technical universities, railway undertakings and rolling stock producers.

Detailed information is available at **www.ikolej.pl**

International Trade Fair for Transport Technology InnoTrans 2016

The successive 11th edition of International Trade Fair for Transport Technology InnoTrans 2016 took place on 20-23 September. 2950 exhibitors from 60 countries presented their products and services, out of which 200 businesses held their exhibitions for the first time. The most represented countries included Germany, Italy and France. InnoTrans 2016 Fair, as the leading international fair for transport technology in the world, not only gathered a record number of exhibitors but also enjoyed a great popularity and interest among around 145,000 visitors coming from over 140 countries.

The participation of the Railway Research Institute, as in previous years, was not only connected with its own exhibition stand but also with the presence of nearly 100 employees who visited the fair taking advantage of the opportunity to meet foreign partners and see the new arrivals in the transport sector.

International Railway Research Board (IRRB)

Director of Railway Research Institute joined International Railway Research Board (IRRB).

During the 89th General Assembly of the International Union of Railways (UIC) held on 1 December in Saint Petersburg, Director of the Railway Research Institute, Andrzej Żurkowski was elected to International Railway Research Board (IRRB). As a result of UIC General Assembly election, Prof. **Boris Lapidus** (RZD) was renewed as IRRB Chairman, whereas **Vicky Brown** (ACRI), **Guven Kandemir** (TCDD), Prof. **Marc Robinson** (Newcastle University), **Roman Sterba, Ms Brown** (ACRI) and **Andrzej Żurkowski** (Railway Research Institute) were appointed as vice-chairpersons of IRRB. Director A. Żurkowski will be in charge of a task from Area 1, i.e. Update of the Global Vision for Railway Development. IRRB, an international Board founded by UIC, is aimed at providing coordination of activities to effectively implement technical, technological and organizational innovations in rail transport. The Board's activities in this respect support the development of national and regional transport, elevating it to a global rank.

Photo: UIC

IK's magnetic fields mobile measuring system

Dominik Adamski
Research Technical Specialist
Railway Traffic Control and Telecom Division

Common using of axle counting technology as a track vacancy detection systems by the European railway infrastructure managers has visualized issues of immunity of these devices to interferences generated by the rolling stock. Another aspect of this issue is also equipping rail vehicles with electrical and electronic devices with an increasingly complex structure. Both electric traction units and coaches with installed electronic equipment generate interferences at frequencies similar to or identical with frequencies used by the above mentioned vacancy detection systems. Wheel sensors used by train detection systems in a particular part of a track layout are exposed to disturbances at the same rate as wheel sensors used in axle counting systems. Gained experience shows that particularly modern vehicles (including high-power units) with installed electronic devices cause disturbances in work of wheel sensors used above all in track vacancy detection systems.
The Railway Research Institute has got at its disposal calibrated measuring equipment that meets current European requirements for such type of tests. The measuring system includes: two measuring antennas, a mobile computer (laptop) with software for data processing and archiving, three oscilloscope cards, two TNB modules with integrated impedance transformers, and a measuring cable. Voltage values induced within the antennas are registered by the oscilloscope cards. The registration results are sent to the measuring computer where consequently a FFT analysis is performed, using specialized software. The analysis results in values of magnetic field strengths generated in frequency function compared to boundary values of each of measured surfaces. In the ERA/ ETRMS/033281 document there are mentioned measurements of magnetic field strength with one measuring antenna. A method used in the Railway Research Institute with two measuring antennas (Fig.1) significantly reduces a number of performed travels and enables complex evaluation of tested rolling stock, regardless possible asymmetry of disturbance source placement on a vehicle in relation to track axis, which is significant during tests performed on a railway route.

Fig. 1 Measuring antennas mounted to the rails

So far, research works performed by the Railway Research Institute have been carried out for vehicles operating in 3 kV DC system and concerned evaluation of meeting requirements in a process of approval of vehicles for the network managed by PKP PLK S.A. and other infrastructure managers.

A new area of the Railway Research Institute's activity are tests of vehicles operating in alternating current traction system. An example of it are tests of magnetic fields emitted by electric traction units operating on the Norwegian railway network with 15kV 16 2/3 Hz traction power supply. The tests were performed by a team of the Railway Research Institute's employees assisted by representatives of Norwegian railways and the manufacturer of track vacancy detection systems. Test stands were located in two points: on the route adjacent to Mysen railway station and on the route adjacent to Spydeberg railway station. The measurements were taken for basic operation states (braking, acceleration, running at constant speed) and for cases of vehicle absence in the vicinity of measuring antennas (so called background measurements). In *Fig. 2* there is presented an exemplary result of magnetic fields strength registered during the tested vehicle acceleration and implemented electric braking. In red there are marked magnetic fields boundary values according to ERA/ ETRMS/033281 requirements and with blue – measured values.

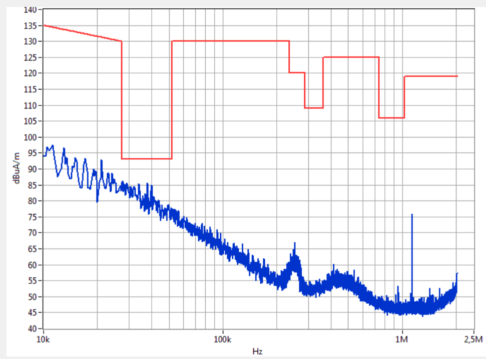

Fig. 2 Magnetic field strength in X direction

The performed tests demonstrated that an alternating current traction system in contrast to 3kV direct current traction system is characterized by a relatively high value of magnetic field strength in Y and Z surfaces. A potential source of these disturbances may be a return current in rails. The highest values of magnetic fields strength are noticed within 10-40 kHz frequency band. An analysis of presented charts allows concluding that wheel sensors working in these frequency bands are particularly exposed to these types of disturbances. Therefore it is justified to perform magnetic field emission strength tests in case of placing new and modernized rolling stock in service. On the Norwegian railways such tests were performed by the Railway Research Institute only after placing vehicles in service and occurring vague situations concerning compatibility of electric traction vehicles with wheel sensors used in axle counting track vacancy detection system. The performed magnetic fields tests at the stage of approval allow eliminating sources of disturbances caused by vehicles already at that stage of tests. The Railway Research Institute has got at its disposal for the purpose of magnetic field test a calibrated measuring equipment, a mobile measuring stand with a possibility of installation on any railway route and also a stand in the Test Track Centre in Żmigród, as well as a team of qualified personnel with extensive experience in the mentioned above tests.

dadamski@ikolej.pl

Shift^{2}Rail – Call for proposals 2017 now published

Eliza Wawrzyn
Scientific Assistant

The Shift^{2}Rail Joint Undertaking (S^{2}R JU) has published the 2017 call for proposals and its Annual Work Plan 2017.
This new round of call for proposals is for S^{2}R members (Funding Members and Associated Members) and for non-JU members (Open Calls).
Indicative budget of S^{2}R co-funding amounts to 60.8 €million for proposals 2017. The following topics for proposals open to all non-JU entities have been published:

1) S^{2}R-OC-IP1-01-2017: Innovative materials & modular design for rolling stock applications
The use of composite materials is nowadays frequent in many sectors […] For railway vehicle carbodies […] the challenge is to create new constituent and composite materials adapted to the special railway environment requirements. For access door systems, the challenge is to make a breakthrough related to cost, weight, acoustic and thermal performances of door leaves […]
With regard to the modular design, […] the challenge is to develop new technologies and products which could increase the capability and flexibility of rolling stock throughout its lifetime.
Funding: 3.5 €million

2) S^{2}R-OC-IP1-02-2017: Tools, methodologies and technological development of the next generation of Running Gear
The challenge is to develop and combine adequately suitable technologies to produce light, reduced noise, track-friendly, reliable, low life-cycle-cost (LCC) running gear. This multi-technology approach will have to address several functions (comfort, curving, structural function, rolling components, health monitoring, etc.).
Funding: 2.8 €million

3) S^{2}R-OC-IP2-01-2017: Operational conditions of the signalling and automation systems; signalling system hazard analysis and GNSS SIS characterization along with Formal Method application in railway field
The challenge is to boost innovative and cost-efficient technologies and systems for railway signalling, and automated driving while, at the same time, achieving a level of safety consistent with methods and standards to be applicable in all railway segments.
In the framework of the technological developments foreseen within the Innovation Program 2 (IP2) of Shift^{2}Rail Master Plan, the specific challenge is to apply GNSS in safety railway applications, new train separation system (Moving Block) and automatic driving (ATO).
Funding: 1.8 €million

4) S^{2}R-OC-IP2-02-2017: Energy harvesting methodologies for trackside and on-board signalling and communication devices. Adaptation of already existing technologies for developing a purely on-board Train Integrity
The challenge is: to develop competitive solutions for enhancing train integrity functionalities and for trackside object controller deployment;
[…] to overcome communication issues and provide the suitable energy supply for on board train integrity devices also in those cases where trains (especially freight trains) do not have any power supply available on the wagons;
[…] to identify the best technical system […] to be used for achieving the On Board Train Integrity feature and to identify the best engineering solution for energy feeding of the trackside object controller.
Funding: 1.7 €million

5) S^{2}R-OC-IP3-01-2017: Smart metering and asset management of railway systems
The challenge is: […] non-intrusive Smart Metering sensor networks at Railway System level;
[…] open system and interface for data collection, aggregation and analysis in an open source Operational Data Management (ODM) Platform;
[…] set of User Applications design and specifications […] with the aim of enhancing the energy decision making and the line operation patterns, as well as other possible improvements such as preventive maintenance;
[…] to generate knowledge from data and/or information;
[…] valid for life cycle management and intelligent asset maintenance planning […].
Funding: 2.2 €million

6) S^{2}R-OC-IP3-01-2017: Future stations and accessibility
High capacity stations […] are likely to have issues with congestion, guidance and security that are not experienced in more remote stations. The challenge is to improve security in large stations with the use of big data, digital analysis and technologies providing models for human behaviour. Another challenge is to improve the customer experience at high capacity stations with regard to boarding the train with ease and safety, in particular for persons with reduced mobility (PRM).This has to be achieved giving due consideration to the safe integration of the proposed solutions in the infrastructure subsystem.
Funding: 1.2 €million

7) S^{2}R-OC-IP3-03-2017: Satellite and autonomous monitoring systems' solution
One of the objectives of the S^{2}R Master Plan Innovation Programme 3 (IP3) "Cost efficient and reliable infrastructure" is to enable the development of autonomous and unmanned vehicles for railway network monitoring, by processing data captured by those devices in order to generate relevant maintenance infrastructure-related information. The specific challenge [...] relies on the technology development and demonstrator implementation in the field, to assess operational interests and feasibility in terms of which elements/parameters can be measured via unmanned aerial monitoring, and with which accuracy, to fulfil requirements of the specific applications.
Funding: 0.6 €million

8) S^{2}R-OC-IP4-01-2017: Smart technologies for trip tracking and improved travel companion and trip tracking
In the Shift^{2}Rail Master Plan, IP4 is focusing on proposing a new seamless approach for door to door journeys […]. This seamless access will be enabled by a "travel companion", using advanced human-machine interface features, adapted to the services to be displayed, the environment, and the passenger preferences. Real-time information […] needs also to be proposed […]
Starting from an existing but simplified mock-up of travel companion […], the challenge remains to radically enrich the end-user experience […]. Another challenge is to enhance the tracking of a journey using smart mechanisms […], using decision making process to define when and how the journey of users can be affected.
Funding: 3.5 €million

9) S^{2}R-OC-IP5-01-2017: Real-time yard and network management
The challenge […] consists in providing a consistent set of data describing the processes and resource allocation in the yard and the surrounding railway network in real-time. […]
Innovation […] will rely on improved decision support in ad-hoc timetable planning to optimize operational processes that connect freight traffic in yards and terminals with timetable slots […]. A challenge […] is to model the data management processes of an existing network […].
The flow of data […] must fulfil the requirements defined in TAF TSI regulation and profit of the existence of […] the TAF TSI XML catalogue. […] Developments for tracking wagons and loading status shall take into account existing platforms at EU level implementing TAF TSI (ISR – RAILDATA).
Funding: 1.5 €million

10) S^{2}R-OC-CCA-01-2017: Smart maintenance and human capital
Smart Maintenance: […] In the future in many of the most important railway subsystems and components will implement Condition-Based Maintenance (CBM) techniques and systems […]. However, up to now there is very little knowledge concerning data analysis applied to the prediction of maintenance activities required to prevent component failures. This topic aims at carrying out CBM research activities for the part related to passenger trains […].
Human Capital: […] is to cover the future needs of the railway sector in terms of human capital focusing on customer-oriented design of mobility, with an overall objective to bridge the gap between the massive changes in the railway and other industrial sectors imposed by rapid technological advances […] and the substantial demographic change […].
Funding: 0.7 €million ((Smart Maintenance: 0.47 €million, Human Capital: 0.23 €million)
Proposals can be submitted from 10th January 2017 and the deadline is 30th March 2017.
Full details of the Shift^{2}Rail Call for Proposals are available through the S^{2}R website or the H2020 portal.

ewawrzyn@ikolej.pl

New rules for assessment of composite brake blocks by Notified Body

Zbigniew Cichocki, PhD, Eng.
Expert
Rail Vehicle Division

Commission Regulation (EU) No 321/2013 concerning the technical specification for interoperability relating to the subsystem 'rolling stock — freight wagons' of the rail system in the European Union (TSI WAG) needed to be amended in order to close the open point referred to in Table A.1 of Appendix A relating to the assessment by Notified Body of composite brake blocks. In accordance with Article 3 of the Agency Regulation and with the work program of the Agency, a working party had been established for analysing this open point and making proposals for harmonized rules to be specified in the TSI to close it. This working party completed its work in January 2014, and as a result, the Agency has finalised the corresponding amendments to the WAG TSI.

Assessment of composite brake blocks according to Commission Regulation (EU) 2015/924 of 8 June 2015.

In Chapter 5 „Interoperability constituents" Commission Regulation (EU) No 321/2013 the new point 5.3.4.a is added: 5.3.4a "Friction element for wheel tread brakes".

The friction element for wheel tread brakes shall be designed and assessed for an area of use defined by:

- dynamic friction coefficients and their tolerance bands,
- minimum static friction coefficient,
- maximum permitted brake forces applied on the element,
- suitability for train detection by systems based on track circuits,
- suitability for severe environmental conditions.

This new interoperability constituent, e.g. friction elements for wheel tread brakes shall comply with the requirements defined in point 4.2.4.3.5.:

The friction element for wheel tread brakes (i.e. brake block) generates brake forces by friction when engaged with the wheel tread. If wheel tread brakes are used, the characteristics of the friction element shall contribute reliably to achieving the intended brake performance. These requirements shall be assessed at the IC level. The demonstration of conformity is described in point 6.1.2.5 of this TSI. The demonstration of conformity of friction elements for wheel tread brakes shall be carried out by determining the following friction element properties in accordance with the European Railway Agency (ERA) technical document ERA/TD/2013-02/INT published on the ERA website:

- dynamic friction performance (Chapter 4),
- static friction coefficient (Chapter 5),
- mechanical characteristics including properties in respect to shear strength test and flexural strength test (Chapter 6).

Determining this interoperability constituent properties is mandatory.

If the friction element is intended to be suitable for

- train detection by systems based on track circuits and/or
- severe environmental conditions,

demonstration of this suitability shall be carried out in accordance with Chapters 7 and/or 8 of the ERA technical document ERA/TD/2013-02/INT published on the ERA website.

The manufacturer of the interoperability constituent or their authorised representative established in the European Union have the choice to decide whether their product will be suitable for:

- train detection by systems based on track circuits, and/or
- severe environmental conditions.

If an interoperability constituent is not suitable for train detection by systems based on track circuits, this will be recorded in the technical file accompanying the EC declaration.

The same applies to severe environmental conditions.

Technical document friction elements for wheel tread brakes for freight wagons (ERA/TD/2013-02/INT) provides the necessary specifications to perform the assessment of conformity of friction elements for wheel tread brakes/composite brake blocks. It is referred to in point 6.1.2.5 and Appendix D of the technical specification for interoperability relating to the subsystem 'rolling stock –freight wagons' (TSI WAG). This document is based on EN 16452: 2015 Railway applications - Braking -Brake blocks,

In the previous WAG TSI composite brake blocks that could be used in the subsystem freight wagon were listed in a list of fully approved composite brake blocks (Appendix G of the WAG TSI).Their assessment procedure by a notified body was an open point. Instead, they were subject to UIC approval procedure as by 1 July 2015 this had been the only available methodology to assess composite brake blocks.

Commission Regulation (EU) 2015/924 of 8 June 2015 relating to the 'rolling stock —freight wagons' subsystem of the rail system in the European Union closes this open point. It introduces a new interoperability constituent 'friction element for wheel tread brakes' together with its conformity assessment procedure. The assessment of conformity of the interoperability constituent 'friction element for wheel tread brakes' is performed by a notified body using clearly defined criteria.

zcichocki@ikolej.pl

Technical and operational aspects of High Speed Lines' use for regional trains

Andrzej Żurkowski, PhD, Eng.
Director of Railway Research Institute

Launching a number of intercity connections in Poland in December 2014 by ED250 trains (Pendolino), at the speed of 200 km/h on the upgraded CMK line, according to Directive 2008/57 on rail interoperability, marks the beginning of High Speed Rail (HSR) system in Poland. At the same time, the ETCS level 1 devices to carry out movement of trains were used for the first time. These events are a prerequisite for a series of research and technical tests which would be the basis for gaining national experience in this area.
Foreign experience in this field shows, that in many cases High Speed Lines (HSL) become rapidly saturated especially when they connect very large agglomerations. Then the problem arises not only to achieve high capacity of railway nodes, but considerable traffic flow on the lines.
In the Polish conditions it can be assumed, that such a saturation on high speed lines (the planned line "Y", CMK and others) will occur in several years' perspective. In order to improve the HSL technical and economic efficiency it is reasonable to consider the possibility of using them simultaneously for the railway high speed and regional transport. The practice of European HSR systems also provides experience in this field.
The movement of trains on the HSL is performed – due to the (usually) similar technical parameters of all high-speed train sets – basing on a parallel graph (clock-face timetable). Therefore a simple formula can be used in order to calculate the capacity of HSL:

$$N_d = k \cdot \frac{60}{t_n} \quad [\textit{pairs of trains per day}] \qquad (1)$$

where:
N_d – daily capacity of HSL,
k – number of hours of running HSR trains during the day,
t_n – minimal interval time (headway) between two successive trains [min.].

Changes in capacity and additional regional traffic associated with the introduction to the HSL depend on several technical and organizational factors. For example, there are several possible variants of the potential HSL use for the needs of regional traffic, especially related to the passage of trains on all or only a part of the HSL, stops at intermediate stations, etc. Also the type of railway signalling, technical characteristics of the line, traction power supply system, speed of trains etc. are of great importance.
Potentially there are a number of options to use HSL to regional transport. They were symbolically presented in Figure 1

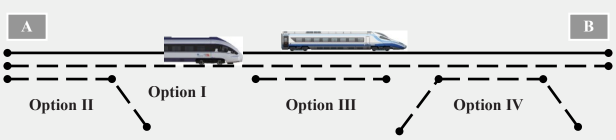

Fig 1. Four options of HSL use in regional transport

Option I refers to the case when the ratio of regional trains overlap the entire length of the line, thus fulfilling the functions of driving and car sharing travellers from the station to the intermediate station nodes A and B. In subsequent versions regional trains use only part of the HSL joining intermediate stations with the nodal ones (II), intermediate stations between each other (III) or the stations which are located beyond of the High Speed Line (variant IV).
The problem comes down to determine **the reduction coefficient** ε indicating how many HS trains paths on the train diagram are reduced (in one hour) by one regional train. The analytical value of ε can be calculated by the formula:

$$\varepsilon = \frac{n \cdot I}{60} \qquad (2)$$

where:
ε – the reduction coefficient,
n – reduced number of HS train paths on the diagram,
I – headway time [min],
60 – the number of minutes in an hour [min.].

To carry out an overall assessment there is presented an example of calculation for two levels of regional trains (speed 160 and 200 km/h) and three levels of HSR trains (250, 300 and 320 km/h) on the 100 km part of the HS line. It was assumed that the headway time of trains *I* is 5 minutes. The described situation was mapped on the train diagram in Figure 2. Value Δt is the time equal to the difference during the HSR train and regional journeys. The extra time t_{dod} due to the necessity of maintaining the same ends in the time of HS train departures.

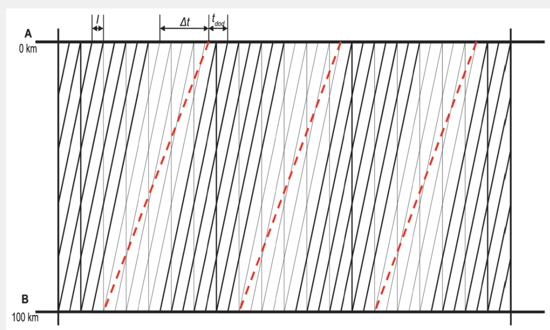

Fig 2. Train diagram for calculation example

For the above case an analytical formula for calculating the number *n* of eliminated train path's can be calculated from the formula. It has the following form:

$$n = \begin{cases} \left[\frac{\Delta t}{I}\right] + 2, \text{ gdy } m > 0 \\ \left[\frac{\Delta t}{I}\right] + 1, \text{ gdy } m = 0 \end{cases} \qquad (3)$$

In the above formula *m* represents the number of mantissa resulting from dividing the $\Delta t/t$.
The calculated values of the coefficient of reduction ε was given in Table 1.

Technical and operational aspects of High Speed Lines' use for regional trains (C.d.)

Table 1. The train path reduction coefficients

Reduction coefficients ε		High Speed Trains		
		250 km/h	300 km/h	320 km/h
Regional traffic	160 km/h	0.42	0.50	0.50
	200 km/h	0.25	0.33	0.33

These results indicate that the movement of the regional trains significantly reduces the HSL capacity, however, it enables their additional use.

The following **conclusions** can be drawn from the analyses. The decision to build a high speed line is preceded by long-term forecasts of demand. These forecasts should be very accurate and based on a possibly large and detailed collection of data relating to the expected socio-economic development of a country and region under consideration. The study of the potential inhabitants' mobility should also take into account the regional traffic, in order to assess possible benefits of using HSL to such traffic.

Regional train sets intended on High Speed Lines should demonstrate considerable accelerations and speeds, in order to reduce capacity of the line as much as possible. At the same time the driving cab should be equipped with signaling devices. High Speed Lines require considerable investment and are expensive to maintain. In the case of HSR under-utilization of their capacities, it is therefore reasonable to introduce regional traffic which improves their profitability.

azurkowski@ikolej.pl

High-speed circuit breakers DC have been used for over 100 years

Artur Rojek
Chief Researcher
Head of Electric Power Department

The High-speed circuit breakers DC have been used for over 100 years. During all that time these constructions have been constantly developed and new solutions have been implemented. The monograph by Artur Rojek entitled "High-Speed Circuit Breakers DC in Rail Transport", published by the Railway Research Institute, is dedicated to these electrical apparatuses. It consists of ten chapters and conclusions.

Chapter 1, the introduction, covers the history of high-speed circuit breakers starting with T. Edison's patent, through magnetic blowout breakers to ultra high-speed breakers that use semiconductors and counterflow breaking method.

The monograph also deals with problems connected with the occurrence of short circuits in DC circuits of electric traction power supply systems, high-speed circuit breakers modeling, legal and normative requirements that high-speed circuit breakers have to meet and the division of breakers due to their installation, parameters and breaking method.

Two chapters are dedicated to the description of DC breaking process and its accompanying phenomena such as ionization and deionization of electric arc, external factors affecting electric arc and connection overvoltage. Moreover, the influence of other equipment (mainly) components' filters of rectified voltage) on the short circuit current and its breaking by a high-speed breaker.

A crucial issue discussed in the monograph is the coordination of short-circuit protection in the juxtaposition of a traction vehicle and a traction substation. In the chapter which deals with this problematics, test results of breaking selectivity are presented when various types of high-speed breakers were used.

A significant part of the monograph focuses on the construction and principle of DC high-speed circuit breakers' operation. That chapter is devoted to the description of various breakers' construction, how their basic elements are built and how they operate, particularly as regards drives, triggers, arc chute and magnetic blowout devices. Considerable attention was given to the parameters of high-speed circuit breakers, particularly opening and arcing times, as well as breaking capacities of critical currents.

The monograph is complemented by a description and an overview of high-speed breakers' parameters used in rail transport in Poland and Europe.

arojek@ikolej.pl

The Railway Research Institute's 2017 Seminar Programme

January 24th, 2017	
Assist. Prof. Juliusz Sołkowski, Ph.D. Eng. (Cracow University of Technology)	Spring Elements in Rail Superstructures – Analysis of European Experience and Regulation Proposals for Polish Railways
February 7th, 2017	
Assist. Prof. Bolesław Augustyniak, Ph.D. (NNT Sp. z o.o.)	Polish Innovative Methods of Non-destructive Steel Elements' Diagnostics
March 14th, 2017	
Marek Stolarski, M.Sc. Eng. Michał Biszczuk, M.Sc. Eng. (Neel Sp. z o.o.)	3 kV DC OCL Support Structure in the Aspect of Operational Problems Occurring in Upgraded Railway Lines Equipped with Heavy Type Catenary
April 11th, 2017	
Piotr Chyliński, M.Sc. Eng. Szymon Klemba, M.Sc. Eng.	Shaping of Transport Offer - Integrated Timetables
May 16th, 2017	
Szymon Klemba, M.Sc. Eng.	Integrated Tariff Systems as Element of Transport Offer
June 6th, 2017	
Piotr Tokaj, M.Sc. Eng. Witold Groll, M.Sc. Eng.	Noise in Railway Sector
September 12th, 2017	
J. Młyńczak, Ph.D. Eng. M. Gołębiewski, M.Sc. Eng.	Testing and Implementation of Non-incandescent Light Sources for Rail Signalling
October 10th, 2017	
Andrzej Kulka, M.Sc. Eng.	Effect of Load on Stress Distribution during Endurance Bench Tests of Railway Vehicle Bogie Frames
November 14th, 2017	
Danuta Milczarek, M.A.	Effect of Thermal Radiation Intensity on Toxic Gases Emission Released in the Course of Combustion Applying Fourier Transform Infrared Spectroscopy *FTIR*
December 5th, 2017	
Piotr Tokaj, M.Sc. Eng.	In-service Field Testing of Rail Friction-Shoes Pairs

IK - Railway Research Institute
04-275 Warsaw, Poland
www.ikolej.pl
E-mail: ikolej@ikolej.pl