results are outlined, including recommendations for improving protection characteristics, developing computer models, introducing new circuit solutions, and implementing improved relays as prototypes.

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HYBRID TRACTION SYSTEM FOR DIESEL TRAINS

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Abstract. The article analyzes improving the traction and energy performance of diesel motor-car rolling stock. It is determined that a significant improvement can be achieved by using hybrid traction systems.
Keywords: hybrid traction system, energy efficiency, motor-car rolling stock

Introduction.

Topicality. Improving the characteristics of suburban rolling stock is a key area for ensuring high competitiveness of suburban passenger transportation. Therefore, it is important to improve the outdated motor-car rolling stock used by JSC "Ukrzaliznytsia" for suburban passenger transportation.

The object of research is diesel motor-car rolling stock for suburban transportation.

The subject of the research is hybrid traction systems for diesel trains.

The goal of this work is to study hybrid traction systems for their application on diesel trains.

The tasks of the study are to analyze the circuitry solutions used in hybrid traction systems of diesel trains, to determine the parameters of operating modes for optimization of hybrid traction systems.

The novelty lies in the development of methods for creating a hybrid traction system for a diesel train and algorithms for its control.

Presentation of the main research material.

Suburban passenger transportation by rail is an effective way to improve the mobility of the population. To ensure the high competitiveness of these services, they must have low costs and provide a high level of comfort. Today, the production units of JSC "Ukrzaliznytsia" carry out overhauls of rolling stock aimed primarily at improving passenger comfort, improving the working conditions of the locomotive crew, increasing traffic safety, etc. The electrical equipment of auxiliary systems is being partially replaced with modern analogues. However, no changes are made to the traction system, which directly affects the consumption of fuel and energy resources, during repairs. Since traction systems are mostly based on outdated technical solutions, they consume increased fuel and energy resources. This situation can only be improved by using modern energy-efficient traction systems.

A key technology for reducing fuel and energy consumption is energy recovery during electrodynamic braking. Energy accumulation in an on-board storage device can reduce energy consumption by up to 40% per acceleration and braking cycle [1].

On electric trains and diesel trains with electric power transmission, the integration of energy storage into the traction system is quite simple. For diesel trains with hydraulic transmission, it is necessary to use auxiliary equipment, such as the Hybrid Powerpack system from MTU [2].

Another important aspect of the use of onboard energy storage is:

1) the ability to exclude the operation of the primary energy source in modes with high consumption of fuel and energy resources or insufficient energy consumption;

2) increasing the power of the power plant without increasing the power of the primary energy source;

3) autonomous movement with a non-operating primary energy source, including its complete exclusion from the traction system.

To obtain the greatest effect, the traction system of motor-car rolling stock should be built using energy-efficient traction electrical equipment.

Today, traction asynchronous electric motors are the most commonly used. Rolling stock equipped with traction synchronous motors with permanent magnets is in trial operation [3]. Traditional synchronous generators with electromagnetic excitation, asynchronous generators, and recently the use of synchronous generators with permanent magnet excitation has become widespread.

As for the converter technology, the improvement of its energy performance is associated with both the use of a modern element base and the improvement of circuitry and control algorithms, which generally affects the energy performance of the traction electric drive.

An important area of reducing energy consumption and negative impact on the environment is the introduction of energy-saving traffic modes.

Conclusions. to increase energy efficiency of existing motor-car rolling stock, it is necessary to use modern equipment and on-board energy storage systems, as well as to introduce energy-saving algorithms for traction system strategies, algorithms and train movement.

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MULTICRITERIAL, MULTIPARAMETER OPTIMIZATION OF AXIAL RECYCLING TURBO-EXPANDER UNITS

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Abstract. The national energy independence and autonomous power supply of critical infrastructure facilities directly contributes to strengthening of the national security and independence. The turboexpander development and implementation, which corresponds to the level of world achievements, using ASTM (American Society for Testing and Materials) requirements and harmonized with API (American Petroleum Institute) 617 standards, utilizing cutting-edge methodologies and advancements in science and technology, represent a pivotal contemporary challenge. This study gathered key parameters from 93 gas distribution stations and proposes conducting scientific research to explore the feasibility of employing multicriterial multiparameter optimization for the flow components of axial turbines, considering operational conditions, and leveraging existing operational turbo-expander units. Using new methods and methods of modern achievements of