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TRENDS IN THE CREATION OF MODERN AUTOMATED TRANSMISSIONS OF HEAVY CARS

Automatic and automated transmissions are widely used on a number of mobile vehicles, in particular, on vehicles equipped with hydromechanical transmissions (GMT). GMT is much easier to automate than mechanical transmissions, while this type of transmission can significantly improve the traction and speed properties of the vehicle, increase its cross-country ability, increase the service life of the transmission, as well as increase safety and facilitate the operator's working conditions [1, 2]. The technical level and efficiency of using modern heavy-duty vehicles largely depend on the type of transmission, the number of gears, the difference in the gear ratios of adjacent gears, the number of ranges, the method of gear shifting, reliability and their cost. At the same time, such transmissions must provide not only good dynamic characteristics of the vehicle movement, but also the performance of a large number of technological operations in a wide range of speed and load modes. Therefore, when creating new attractors, it is necessary to correctly synthesize the structure of the transmission and select its rational design parameters that provide high functionality at low costs for manufacturing and operation.

Modern equipment, which is operated at mining and processing enterprises (mining dump trucks, mine land trucks, road construction machines), is equipped with electronic on-board diagnostic, monitoring and control systems that allow to quickly (in real time) assess the technical condition of the engine, transmission and other mechanisms mobile machine.

Previously, the analysis of the technical condition of complex vehicle mechanisms was carried out through scheduled preventive work, which provided for periodic disassembly of mechanisms and parts after the vehicle had worked out a certain period of operation or passed a given mileage. However, this type of work is very expensive, time consuming and often economically unprofitable.

When creating modern heavy vehicles, they try to provide equal strength elements of mechanisms and parts. However, the operating conditions of these mobile machines are so diverse, changeable and ambiguous that the values of many parameters during operation changed in very wide ranges, often reaching and exceeding the maximum permissible values.

As a result, the system of planned preventive works has outlived its usefulness. has become ineffective. It does not allow timely identification of dangerous deviations of parameters, detecting failures and hidden defects, preventing the occurrence of malfunctions and predicting the residual life of a car, tractor, road construction machine, etc.

In modern market conditions, new innovative approaches to the processes of technical diagnostics are needed. Such an innovative approach was developed at the Department of Automobiles of BNTU and tested in relation to the diagnosis of

complex mechanical (MT) and hydromechanical transmission (GMT) cars. This approach provides for a complex of research and a number of scientific and technical stages [3, 4].

The innovativeness and novelty of approaches to the automation of control and diagnostics of automobile transmissions lies in the fact that here, at the theoretical and experimental levels of research, it is assumed that there will be widespread use of simulation of the physical properties of elements and the use of forced bench and factory tests aimed at obtaining the necessary information, as well as the use of information and intelligent technologies, which together will make it possible to develop adaptive algorithms for their subsequent implementation in on-board automotive electronic control and monitoring systems.

Analysis of the development of designs for automated transmissions of heavy vehicles and other mobile machines, both domestic and leading foreign firms (Komatsu, Caterpillar, BelAZ, Clarc, Volvo, Terex, Liebherr) shows that there is an active use of intelligent technologies in the production of modern mining equipment. In addition, a number of firms have developed an interest in all-electric dump trucks. For example, by order of Ciments Vigier SA, two companies – Kuhn Schweiz AG and Lithium Storage GmbH, based on the Japanese Komatsu HD605-7 dump truck, developed the E-Dumper dump truck, which runs on an electric engine with a power of 590 kW. The use of hydromechanical transmission limits the carrying capacity of vehicles, and modern technological processes of open pit mining require dump trucks of higher carrying capacity. The electric transmission helps to lift it. Komatsu mining dump trucks with electric transmission are identified by the letter E. In this type of dump truck, the engine is aggregated with a generator, which generates electricity to feed the traction wheel motors mounted in the rear axle hubs.

As a result of the comprehensive research carried out, the following trends in the creation of transmissions have been established.

1. Symbiosis of the process of hybridization of transmissions and the creation of cars with hybrid power plants.
2. Creation of robotic cars based on new information and intelligent technologies.
3. Creation of automatic transmissions adapted to unmanned vehicle control.

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ОСОБЛИВОСТІ ЛАБОРАТОРНОЇ УСТАНОВКИ ДЛЯ ДОСЛІДЖЕННЯ СИСТЕМ КЕРУВАННЯ ПНЕВМАТИЧНОЮ ПІДВІСКОЮ КОЛІСНИХ ТРАНСПОРТНИХ ЗАСОБІВ КАТЕГОРІЇ N_3, M_3

Проведення експериментальних досліджень обумовлено необхідністю створення нових систем керування рівнем підлоги колісних транспортних засобів (КТЗ) з пневматичною підвіскою відповідно до вимог Правил Європейської економічної комісії Організації Об'єднаних Націй (ЄЕК ООН). Зокрема, при проектуванні нових КТЗ категорії М3 для міських та приміських маршрутів, функція керування нахилом кузова КТЗ для полегшення посадки та висадки пасажирів на зупинках є обов'язковою для застосування в системі керування пневматичною підвіскою [1, 2].

Технічна ідея, покладена в основу при розробці нової лабораторної установки полягає в фізичному розділенні сили навантаження $P_б$ на частину системи підресорювання КТЗ, що моделюється, на дві складові: силу навантаження $P_Н$, еквівалентну силі навантаження від маси М в сталому стані системи, та інерційну складову P_J, яка виникає в процесі руху маси М при її переміщенні підчас зміни значення висоти Н – рівня кузова КТЗ відносно опорної поверхні. Складова P_J має бути еквівалентною силі навантаження $P_Н$ від маси М.

Підхід до розділення сили навантаження на дві складові ілюструє кінематична схема стендового комплексу, наведена на Рис. 2.

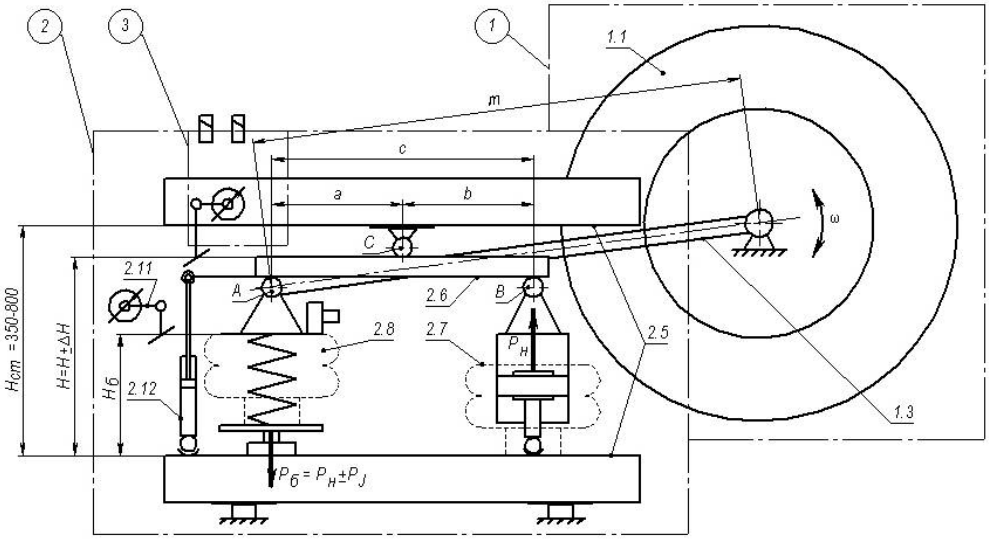

Рис. 2. Кінематична схема стендового комплексу: 1 – великий інерційний стенд; 2 – лабораторна установка; 3 – виконавчий пристрій;