Wrocław University
of Science and Technology

Faculty of Mechanical Engineering

Wrocław, 31.08.2023

Review for the dissertation work of Myrzabekova Dinara Myrzabekkyzy on "Substantiation of parameters and design development of technological machines hinge assemblies operating in underground mines " for the Doctor of Philosophy (PhD) degree on the specialty 6D071200 – Mechanical engineering (Машиностроение).

Foreign Scientific Consultant
Prof. Dr. Hab. Eng. Marek Jan Młyńczak

The author analyzed the reliability of loaders and dump trucks with articulated frame under operating conditions in an underground mine. This allowed the author to choose and substantiate of the research topic relevance, determine the object, subject and purpose of the study, formulate tasks to achieve it.

During the tasks solving, theoretical and experimental studies were carried out by author. In the process of their implementation, the author obtained results that have scientific novelty and practical significance.

The author established that hinge assemblies limit the reliability of underground loaders and dump trucks. Analysis of the hinge assembly parts condition showed that the finger and the sleeve in the hinge were subject to wear. The grades and properties of the finger and sleeve materials are determined. A computer simulation of the parts strength by the finite element method using the Solid Works software package was carried out. The results of simulation confirmed the type and shape of pin and bushing wear in practice.

The author made an assumption and proved experimentally that the reason for the dismantling of the worn hinge was vibration shaking. For this purpose, the author has created an experimental vibration test bench that simulates the working conditions of the hinge in vibration conditions. During the tests, the author experimentally determined the modes of the oscillatory process in which the model of the hinge pin moves up in the bushing despite its weight.

The author proposed to modernize the design of the hinge assembly by equipping it with a dirt protection device and a sensor for monitoring the position of the pin in the hinge. The device designed by the author is patented. The author proposed to perform preventive repairs of the hinge assembly according to its actual condition. For this purpose, the author developed a methodology for maintaining the operability of the hinge assemblies in operation and compiled an information model of the control system for the operability and reliability of machines of the level Maintenance 4.0. To do this, the author offered to collect information from sensors monitoring the position of the finger through wireless communication modules and transmit it to the operability and reliability management system of Maintenance 4.0 level machines.

As a result of the research, the purpose of the dissertation work has been achieved – theoretical provisions have been developed and experimental results have been obtained to improve the efficiency of mining load-haul-dump machines based on ensuring the operability and controllability of the hinge assembly of the turning mechanism.

The estimated cost savings due to the implementation of the research results obtained by the author showed their high efficiency.

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The purpose and objectives formulated by the author, as well as the content of the dissertation itself correspond to the topic of the dissertation. The author independently carried out the entire scope of theoretical, design and experimental research, demonstrating good theoretical training and knowledge in the field of mechanics, automatic control and instrumentation, relying on modern achievements in these field, as well as information and patent publications.

The only drawback is that in the study it was not possible to practically apply the developed design of the patented device on the machine in real conditions of an underground mine.

The dissertation work of Myrzabekova D.M. is a completed scientific work, the choice of methodology, design and technological support and methods of experimental research is fully substantiated. The dissertation is presented in understandable language and illustrated clearly. It may be necessary to note the high innovative component of Myrzabekova D.M.'s dissertation work, the demonstrating of the work content in two articles in journals published in the Scopus database and having a 42 and 44 percentile in mechanical engineering at the time of publication.

This indicates a high level of scientific and engineering training of D.M. Myrzabekova. I believe that Myrzabekova D.M.'s dissertation work "Substantiation of parameters and design development of technological machines hinge assemblies operating in underground mines" is an actual completed scientific research, characterized by internal unity, has theoretical and practical significance.

I am totally convinced that the dissertation work of D.M. Myrzabekova satisfy the requirements of the Ministry of Science and Higher Education of the Republic of Kazakhstan for dissertations for the Doctor of Philosophy (PhD) degree on the specialty 6D071200 – Mechanical engineering.

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