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METHOD FOR DETECTING DEFECTS IN PARTS OF AGRICULTURAL MACHINERY
МЕТОДИКА ВИЯВЛЕННЯ ДЕФЕКТІВ У ЧАСТИНАХ СІЛЬСЬКОГОСПОДАРСЬКОЇ МАШИНИ

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Abstract. *Conceptual bases of the further technical maintenance of quality of carrying out of repairs and maintenance of machines are developed. The analysis and technological foundations for the implementation of holographic methods have been carried out with increasing operational reliability and trouble-free operation of machines in the process of performing agrotechnical work in plant growing and animal husbandry. The article presents the results of the study of the possibilities of realization of different methods and methods of non-destructive control in their choice by their choice for the effective detection of basic defects and damages to obtain adequate indicators for defect and diagnostics of agricultural machines. The methodical principles of creation of holographic images, which are used as an information base for the study of the suitability of parts of agricultural machines, are given.*

Key words: *methodology, detection, parts, agricultural machinery, damage, damage, holography, defects, defect, non-destructive testing, laser.*

Introduction.

Investigation of damages and defects, determination of the parameters of permissible or boundary states, influence on the change of the surface state of the parts of the main types of loads was carried out on two specially created installations that provide the necessary parameters for their interaction (type of load, type of interference fields, their placement, configuration, etc.). Computer holography (the main type of research carried out) allows you to record a change in the surface at low loads, which, with low rates of state change, cause microdeformation. When considering the tasks of non-destructive control as an information process and abstraction from the physical methods used to control and defect the details of agricultural machinery, the following three characteristic consecutive parts of this process can be distinguished:

- obtaining primary information by measuring by means of converters, for example, optical systems, including holography, and bringing it into a form suitable for further processing;

- information processing, using existing computer software and presentation of processing results in a form suitable for analysis and further interpretation;

- analysis of received information and formation of a decision on the state of agricultural machinery (controlled object), the possibility of its normal functioning or forecasting its residual resource.



Formulation of the problem.

On the basis of previous studies and analysis of literature [1, 3], existing methods and technical means of holography have been determined that influence the quality of the implementation of defect detection and diagnostic processes in the implementation of modern technologies for the performance of service work. The image of a deformed body represented in the form of color interference fields is fixed in the memory of the computer [1, 2, 4].

Despite the progress achieved and the practical skills acquired, there are currently no data available on the study of the technical state of the component, assembly, aggregate, or machine as a whole for different types of load (single or aggregated) with the study of bulk fields of micro-deformation of the surface layers.

Holography solving a wide range of various non-destructive testing problems can significantly increase the reliability of agricultural machinery. The means of this method can be effectively used in the implementation [1, 2, 3]:

- a constructive method for increasing reliability in determining geometric characteristics and parameters of the object, its probabilistic strength properties, permissible limits of the use of new materials, the study of individual elements and parts, units and aggregates in general;

- the technological method of determining the parameters of the technological processes of processing and strengthening the surfaces to detect the presence of defects that may arise in violation of the technology of manufacturing parts, and more;

- the repair method for choosing the rational (optimal) method or method of repair, restoration of the working capacity of parts, their working surfaces, repair materials for determining the main and residual stresses that arise in the course of the implementation of reciprocally servicing works.

- operating method for correct selection of machine load modes, thermal mode of machines, predictive terms, maintenance volumes, required modes, and other.

In other methods, the feedback is used in the form of an electric signal, an acoustic wave, a thermogram, and the other, which is most convenient for the registration and further processing of the primary information. Its further processing can be carried out both in the analog type and in digital views, depending on the complexity of the algorithm and the target expediency. Currently the prevalence of the use of digital information processing, which provides a number of benefits. Methods and means for obtaining the primary information regarding the tasks of non-destructive control have now been widely developed and deeply worked out both in technical and scientific plans.

Results

The analysis of possible ways to further improve the efficiency of agricultural machinery use in crop and livestock production indicates the promising introduction of the latest technologies for the performance of service work using holographic methods. In general, during the research, the following types of loads were used: mechanical (stretching, compression, torsion, bending and their complex combination); thermal local, thermal radiation general acoustic excitement by pressure or vacuum, and also for destruction of load samples by impact recommended



by special literature [2, 3].

Studies have been carried out on two-pulse holographic devices by speckle interferometry and its computer manifestation. In the first case (see Fig. 1), the coherent light beam emitted by a laser (1) passes through a collimator formed by two lenses with a curved diameter of 25 mm and a focal length of 20 mm (2) and a convex diameter of 90 mm and a focal length of 200 mm, mirrors (4, 5, 6, 7), comes to a scattering lens (8) with a diameter of 100 mm and a focal distance of 600 mm and is directed directly to the surface of the object under study, the details (13). A specially anticipated regulator of the position of the lens can provide the observation of the upper and lateral surfaces of the product with the help of a mirror 10. Under these conditions, 65% of the intensity of light falls on its upper part.

Methods for the recording of holograms are the methods proposed by Yu.N. Denisyuk and P. M. Boone [1, 5], with the fixation of the film on special protective screens (10 and 11) located directly in front of the object (13). Recording of holograms was performed using two-pulse ruby laser "Lumonics" HL 32 JK Lasers, on AGFA firmware film sensitive to coherent red light. Samples or parts that had insufficient or superfluous reflex ability, were covered with a special paint and applied a coordinate grid on them. The studies were conducted in two-pulse mode when the exposure time was changed from 1 ns to 120 ns. Conditions for conducting the experiment were provided by a specially designed device for the inclusion of a laser (protected by a patent) at the appropriate given moments (Fig. 2). Two-pulse holography was used to investigate the presence of external and sub-surface defects in details that were made of steel, cast iron, plastics, metal-polymers, non-ferrous metals, and others.

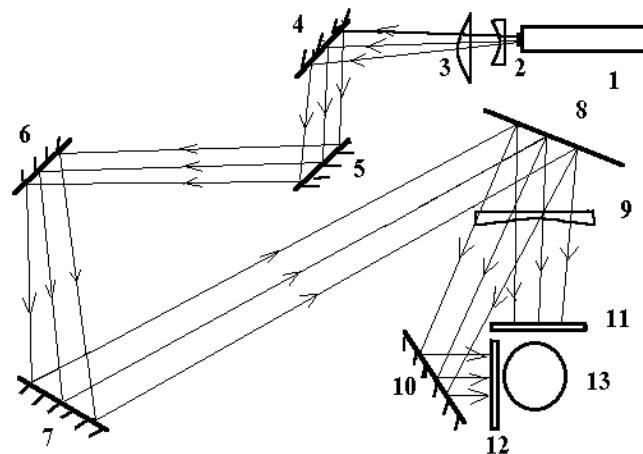


Fig. 1. Optical scheme of research double pulses holography:

1- laser; 2, 3, 9 - lenses; 4, 5, 6, 7, 8 and 10 - mirrors; 11, 12 - shields; 13 - the part of machine

Holography, when determining the technical condition of the parts of agricultural machines, is to implement the following technological methods: the part is prepared in such a way as to create a diffusion reflection of a coherent plane parallel beam of a laser that illuminates the surface of the part. The laser uses helium



- neon, ruby or argon. Ruby laser is used mainly for the implementation of classical holography to study the fleeting processes associated with the destruction of surfaces when determining the boundary parameters of the technical state of products. With the camcorder, they fix the illuminated surface of the part, and the received information in the form of a digital signal through the digital adapter is recorded in the memory of the personal computer.

To ensure a qualitative study of the technical condition of agricultural machines using holography, it is necessary to create conditions for the formation of highly contrasting interference bands in the layer of a photographic emulsion or on a computer hologram. At present, the issues of control of agricultural machinery, equipment and reagent by holographic and optical methods did not turn up and, accordingly, did not study the conditions of holography of surfaces of parts and units of machines, including agricultural ones. The results of studies, analysis of data from literary sources indicate the unconditional relevance of such works and their practical value in improving the reliability of such objects.

Conclusions. Thus, defects may appear on any unlimited surface of the body of the product, have different depth of occurrence, direction, size of disclosure, geometric sizes, configuration, and so on. Detection of defects and damage using conventional methods is rather complicated. It is established that the combination of two types of holography gives one hundred percent result in the presence of hidden defects. The best results were obtained when applying a complex load, with the simultaneous implementation of two or even three types of loads that are diverse in their physical nature.

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Анотація. Розроблено концептуальні основи подальшого технічного забезпечення якості проведення ремонтів та обслуговування машин. Проведено аналіз та технологічні основи впровадження голографічних методів з підвищенням експлуатаційної надійності та безперебійної роботи машин у процесі виконання агротехнічних робіт у рослинництві та тваринництві. У статті представлені результати дослідження можливостей реалізації різних методів та методів неруйнівного контролю за їх вибором за їх вибором для ефективного виявлення основних дефектів та пошкоджень для отримання адекватних показників дефектів та діагностики сільськогосподарських машин. Наведено методичні



засади створення голографічних зображень, які використовуються в якості інформаційної бази для вивчення придатності деталей сільськогосподарських машин.

Ключові слова: методика, виявлення, деталі, сільськогосподарські машини, пошкодження, пошкодження, голографія, дефекти, дефектування, неруйнівні випробування, лазер.