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STRUCTURALLY-TECHNOLOGICAL METHODS OF PROVIDING OF RELIABILITY OF AGRICULTURAL TECHNIQUE BY COMPUTER HOLOGRAPHY

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Summary. There are the aspects of providing reliability of elements of agricultural machines are considered structurally-technological methods during realization of control of their application computer holography in paper. Examples of holograms, which show on possibilities realization of non-destructive control holography are made.

Key words: agricultural machines, computer holography, loading, selection, interference stripe, technological process.

1. INTRODUCTION

Modern agricultural machines and equipments of farms have a difficult complex of physical and mechanical properties. The parts of these machines exploit at considerable productive speeds and technological loading. They work in aggressive environments, have a considerable gradient of temperatures and other. Development of scitech decides the task of providing to reliability of agricultural machines by realization of structural, technological, operating, repair methods, and also backuping of the basic systems [6].

In modern terms the problem of providing of reliability of agricultural machines, their elements is settled by a search creation of new materials, elements of constructions, combination of methods of treatment, strengthening of working surfaces in such combinations, which was before acknowledged practically by impossible or even harmful [5, 8].

In the conditions of providing of high quality of making of parts, elements of constructions, their combination in interfaces is practically impossible without application of modern methods of non-destructive control [2, 3, 4].

Every construction during all term of her exploitation must satisfy to all requirements of

effective exploitation, and also terms of absence of destruction local or general, remaining deformations, damages of pin surfaces, origin of defects, damages and many other. The technical state of machine must satisfy effective external exploitation [9].

2. MATERIAL AND METHODS

Going of parameters of the technical state of parts beyond the set limits, when a machine or her elements dissatisfy to the set norms determine as maximum and impermissible for practical environments [11]. For the estimation of possibility of reliable work of machine it is needed to control these descriptions, and especially value of sizes of possible parameters, them stochastic descriptions of distribution of parameters of the technical state and probability of faultless work [1, 11]

Descriptions of materials, technical state of parts it is determined from one side by structural parameters, and from other, by mechanical properties.

Physical and mechanical properties of working surfaces of materials of parts differ in comparatively the small values of dispersions of sizes, will give out loading, microstrain, long of loading, by the tensely-deformed state and there can be the dispersions presented in a narrow

enough interval at the possible state of working surfaces of parts [17, 18].

3. RESULTS AND DISCUSSION

The results of experimental researches are characterized by stability of pictures of computer holograms [7, 10, 20]. In the conducted researches, for example element to the ploughshare of plough (Fig. 1) with 25 multiple repeated, fixed computer holograms practically similar picture, that enabled to assert: this detail is made without present defects and can be effectively exploited during the certain period of time.

After the condition of experience a detail (ploughshare) was made in accordance with the norms of technical documentation and in obedience to the working drawings. In the process of experimental researches of detail it was loaded in accordance with the worked out methods by a mechanical method (it is differentiated at first, then complex), by a compression with a rollup [12-14]. Such type of loading answers the operating terms of the use of ploughshares.

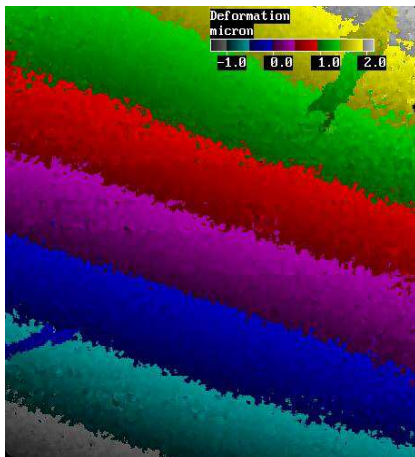


Fig. 1. Computer hologram to the ploughshare of plough, made in obedience to the norms of the working drawings

On absence of damages and defects character of hologram, placing of the coloured stripes specifies is without visible anomalies. A presence on the hologram of scale enables to define the sizes of microstrain in every point of part and work out a mathematical model, which allows adequately the real data to describe the physical process of microstrain under an action

certain after a form, kind and size of loading which would answer the real terms of exploitation of parts.

On the other hand, investigated a ploughshare, in which the parameters of construction elements were set specially by such which do not answer the requirements of designer documentation (a sock or chisel is returned on 5°). Thus, the structural parameter of detail was wrong set beforehand. The got hologram is brought around to Fig. 2.

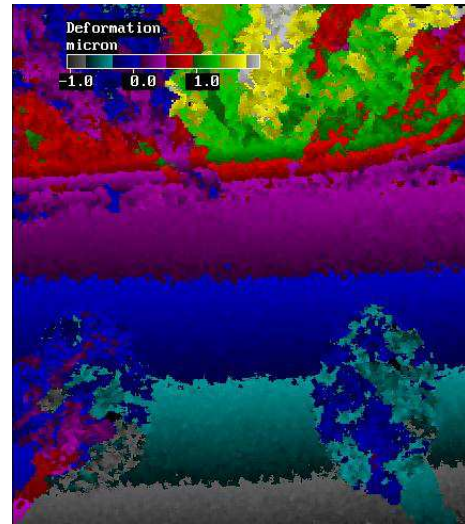


Fig. 2. Computer hologram to the ploughshare of plough with a wrong construction element (the sock of detail is set despite structural norms)

A ploughshare was also loaded with a mechanical method how and parts in first case. Holograms testified to the error of establishment of structural element a presence on them of indignations and anomalies.

Analyzing the state of holograms, resulted on Fig. 1 and 2, it is possible to assert that in first case have correct connection of structural elements with correctly neat materials. As results of operating tests showed ploughshares, which were made on technology which answers the requirements of designer documentation have longevity on 10 - 12 %, and on occasion even to 17 - 19 % higher, than those which are made with violation of norms of constructing. It follows notices, that the second type of detail descriptions which answered the requirements of standards practically had it, and the presence of defects in the areas of connection was limited to technological control on making of parts.

Distribution of size of microstrains, and also size of dispersion of distribution of stochastic sizes it is resulted after total values from all selection from the array of data of all holograms at the mechanical loading (compression) on the example of ploughshares. The results of stochastic researches matter very much from the selection of structural elements or picked up thread parts and knots, as indexes of form of construction can change the values within the limits of one surface [16]. Largely on reliability of all construction or complete set of elements distribution of indexes of durability, value of coefficients of margin of safety influences [4, 15] and distribution of actual deformations of surfaces of parts is under the action of loading. The value of parameters of distribution of these sizes must be taken into account foremost at the choice of material. It is determined the terms of reliability, that the offensive of limit of the possible loading is arrived at by the proportional loading of construction. A maximum value to the parameter is the function of the set admittance on remaining deformation of construction and ordinary methods it is difficult determined.

Substantial influence is on the origin of defects in constructions, especially welding, do the fields of initial tensions, related directly to the correct choice of material and type of construction, without the present concentrators of tensions and study at photographic [9, 19]

The sizes of micro strains presented on a hologram confirm the rightness of version about the choice of material for the ploughshares of ploughs (steel of 45JI), which in the conditions of natural area of Ukraine have satisfactory reliability indexes and yield to the processes of strengthening and conditioning of sharpening. For the presented holograms mathematical models which allow to define the limits of possible exploitation of this type of parts are expected.

Research of parts, made from different materials, for example: cast-iron (CЧ- 18), aluminum (AJI- 9), polymers (polyethylene, polyamide), carbon, and also metal - polymer is reinforced, in accordance with the worked out methods, enabled to fix computer holograms which over are brought in text or in additions of dissertation work. In researches applied all types of loading.

Thus computer holography allows applying the construction method of providing and providing of reliability of agricultural technique, which is used to agriculture of Ukraine.

The technological processes of making and component of machines of the agricultural setting overhaul must with the least expenses of time and facilities to inflict the necessary level of quality and reliability of parts of agricultural machines. Providing of high reliability of technique indexes is possible only at complex combination of structural and technologically-repair methods, especially, for machines and their elements which worked a reappearing resource.

As known [5, 10] reliability indexes do not have direct direct connection with parameters which characterize implementation of technological operations of making of parts or proceeding in their capacity. The sizes of parameters of the technical state largely influence on operating reliability of machines: on firmness to the wear and fatigue, to influence of heterogeneous environments, temperature loading, moments, and others like that. Level of reliability of machine, which is mortgaged at constructing, determined largely by technological discipline at their making or proceeding in the capacity of component elements (of parts), whether repair of machine on the whole. The level of perfection of technology of making or repair determines the level of reliability of wares [8, 12, 13]. In the process of making of parts due to imperfection of technology or subzero productive discipline there are various defects in parts, control allows to avoid which after a productive process by means of different methods and methods.

On the other hand, the technological process of making or proceeding in parts must be examined as a difficult dynamic system with multi-layered intercommunications. The system of determination of technologicalness includes an only complex, which is based on combination actually of technological sequence of implementation of operations, equipment, rigging, instrument, and also methods and controls, organization of productive process, auxiliary and transporting facilities, environments, and others like that. All these components of the single system are in

permanent motion and change, that specifies on the stochastic of passing of process, his parameters carry probabilistic nature and are casual [10, 16]. From one side, a sequence and quality of implementation of technological operations, methods and modes of treatment, influence directly on wearproofness, corrosive firmness, durability, stability of physical find mechanical properties, and from other - objective and subjective factors also influence on quality of implementation of technological operations [16].

On Fig. 3 a hologram over, which recreates and confirms the rightness of the chosen mode of treatment of pin of billow (sharpening and diamond pressing), is brought.

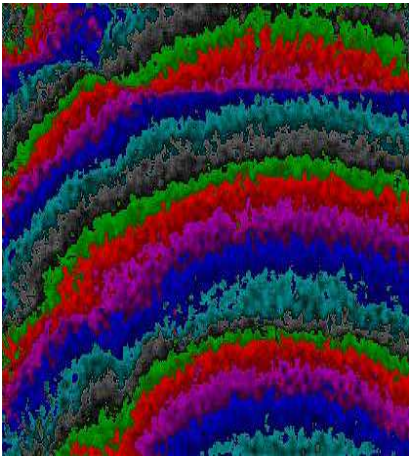


Fig. 3. Computer hologram of pin of billow to the machine-tool (rational mode of treatment of working surface).

The technological systems are a characteristic to change the structure of the system of making of wares, enter additional elements in a productive process, such as: control operations, conduct laying out of implementation of difficult operations on the greater amount of transitions, to create more hard requirements to their realization, at the reasonable change of the modes, that directly influences on the level of reliability of agricultural machines both at making and at repair.

Together with that, what perfect a construction of machine or her component elements, high-quality making or repair, was not it is impossible to provide without the proper control on all stages of their creation.

Property of reliability – longevity is provided by stability of geometrical sizes of wares and them physical and mechanical parameters which are set under making or proceeding in parts. Without accordingly the adjusted control after the process of making or repair of technique it is impossible to create and make a reliable machine. The row of the conducted experimental researches allowed to set a complete fitness and necessity of realization of computer holography as one of optimal methods of non-destructive control after quality of making of parts or process of proceeding in threadbare.

Thus took into account influence of operating terms on longevity of objects, stochastic of processes of both making and use. Results are got by fixing of computer hologram (Fig. 4) from the surface of detail show on considerable rejections in quality treatment.

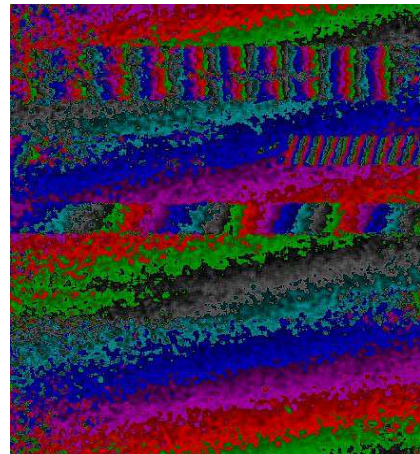


Fig. 4. Computer hologram of pin of billow to the machine-tool (unsatisfactory mode of treatment of working surface).

For realization of the offered methodical recommendations the size of influence of rightness of choice of parameters of making of parts was certain at first, and then is influence of technological parameters on quality of proceeding in threadbare or such which lost the capacity of parts.

The considerable anomaly of stripes on a computer hologram is brought around to pic. 5 shows that this method at all advantages has considerable defects, does not enable to assert about quality surfaces at application of the chosen technology of treatment. In accordance with the plan of experimental researches works

were conducted from the exposure of rational method or method of proceeding in such agricultural machines which lost a capacity.

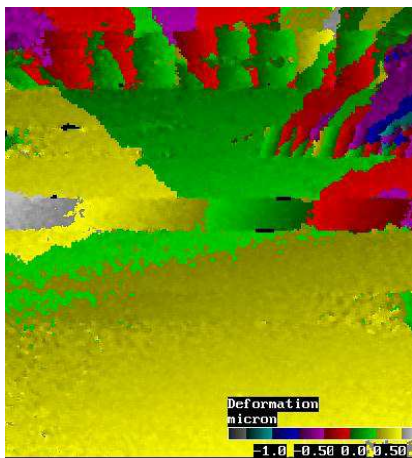


Fig. 5. Computer hologram of bilow picked up thread electro-pin welding on of ribbon from steel 40 X.

Researchers conducted in accordance with the worked out methods of development of the optimal modes of making of parts of agricultural machines with ten's repeated of parts for the exception of chance on the results of experiment [11. 14].

To that end investigated the technical state of working surfaces of parts picked up thread the most modern methods or methods of repair production. To such methods belong: electrical welding, gas-thermal and plasma surfacing, electro-pin baking a lot of metallic layer, electrolytic methods of causing of surface et all. One of most economic and ecologically expedient is the use of the electro-pin welding on of metallic layer.

Due to simplicity and availability of equipment, materials perspective method of proceeding in parts it is possible to realize galvanic coverage's practically in all links of repair production. It follows also to notice that providing of efficiency of galvanic processes at proceeding in parts and them wide distribution is possible mainly, only due to the correctly adjusted non-destructive checking system. In productive terms quality of galvanic coverage's is checked up by an external review and intention of sizes, for example: chroming surfaces. Such approach does not allow adequately estimating the level of quality of the picked up thread surfaces and provide reliability

of machines which repair. Presence of latent sub superficial defects (Fig. 6), reduced by computer holography does not enable to use parts which can create a situation near to the emergency.

On presented on Fig. 6 to the computer hologram an evidently latent defect is sub superficial stratification. At control an external review it was impossible to reduce this defect and a detail answered all requirements of normatively-technical documentation.

One of the most effective methods of proceeding in the capacity of working surfaces of parts of agricultural production there is surfacing under the layer of gumboil and welding works under cover of rare gases, aquatic steam, under gas flame defense and many other. The picked up thread surfaces have high quality and provide reliable and of long duration exploitation with a remaining resource not less than 80% from new.

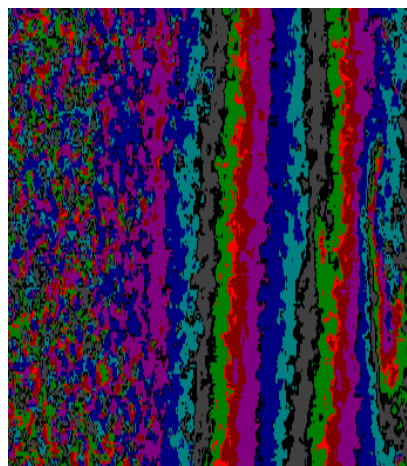


Fig. 6. Computer holography of finger of reciprocator of internal combustion, picked up thread by chrome-plating

About absence of defects of superficial layers of surfaced metals under cover of neutral gas of argon the brought testifies around to Fig.9 computer hologram. For a detail is a representative it was used pin of bilow of pert of giving mechanism beet-lifting to the combine of (PKC-6Б), surfaced a wire (1,0CB-08Г2C) and polished to the nominal size. The size of wear presented a 0,15 mm, and surface of pin small ovality. Surfacing works were conducted without previous treatment of detail with the purpose of leading out of tracks of wear for complication of terms of experience exposure of

additional non-destructive checking features by holographic methods. Possibilities of the computer program allow investigating the separately distinguished areas of surfaces of good of detail or surface of base element of machine by means of holograms.

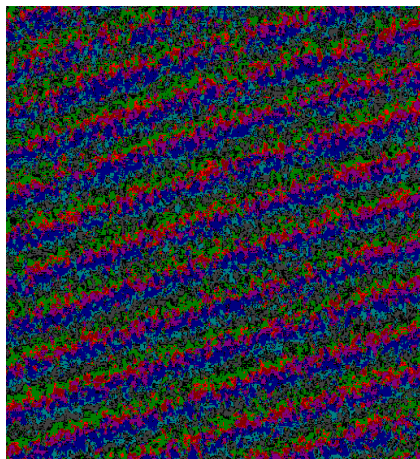


Fig. 7. Computer hologram of surface of detail, surfaced in the environment of argon

Brought around to pic. 8 distribution of size of micro strain along the chosen line testifies to absence of internal damages in a surfaced layer, and the insignificant increase of size of micro strain specifies on the change of size of loading of detail during experience. There is also possibility to study the change of physical and mechanical properties of superficial layers of good along the chosen line, and which characterizes possible changes in the body of good during the test of him for the exposure of imperfect structures.

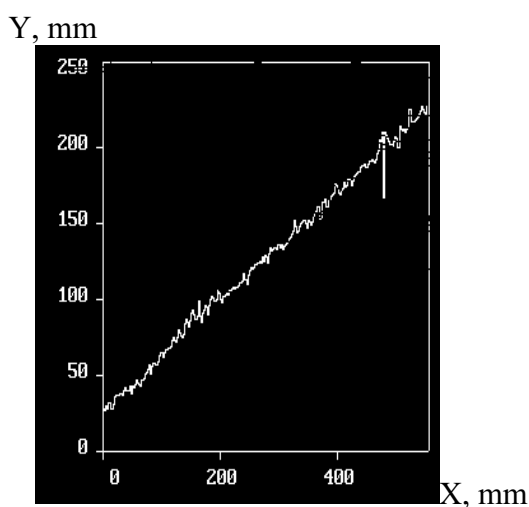


Fig. 8. Distribution of size of micro strain is along the line chosen on a hologram

Examples are made brightly demonstrate possibilities of computer holography at non-destructive control of parts of agricultural machines. It is necessary to mark; that in this work a two-bit/pl over of examples is brought from types of the conducted researches from providing of reliability of machines by means of computer holography. On Fig. 10 a hologram over of glass of bearing surfacing is brought by a wire (1,6 НП-30ХГСА) under the layer of gumboil of (AH-348A) and gnawed through by means of chisel with a hard-alloy plate.

Simplicity of method of control allows him to realize on the enterprises of agricultural engineer, service enterppic.s, proof-of-concept stations. There are possibility creations of the portable systems, which can be based on motor-car platforms and conduct works from control even in the field terms. Corresponding experimental researches were also conducted on a base Gent's of university for the test of parts in the conditions of their direct exploitation.

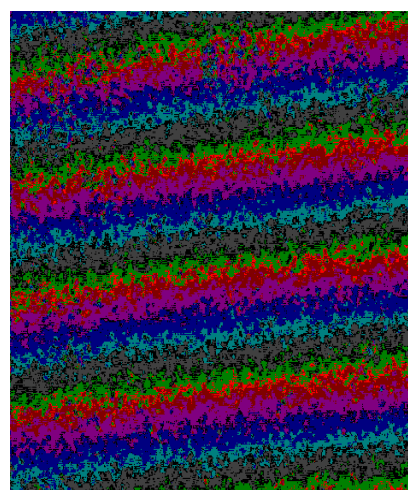


Fig. 10. Computer hologram of detail, the surface of which surfacing under the layer of gumboil

4. CONCLUSIONS

Thus computer holography, as a method of non-destructive control allows to realize the structural, technological and repair methods of providing of reliability of agricultural machines. It follows notices, that holographic methods enable to reduce the latent defects of parts of agricultural machines and create pre-conditions of choice of method of proceeding in a capacity and increase of reliability of machines, what the brought holograms over testify to. For providing

of high-quality study of the technical state of agricultural machines by means of holography it is necessary to create terms, when on a computer hologram contrasting interference stripes appeared highly. For today by the questions of control of agricultural machines, equipment and instruments failed to appear holographic and optical methods and, accordingly, researches of terms of photographic surfaces of parts and knots of machines were not conducted, including agricultural.

The results of researches, analysis of these literary sources specify on absolute actuality in realization of such works and them practical value on business of increase of reliability of agricultural technique.

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**КОНСТРУКТИВНО-ТЕХНОЛОГИЧЕСКИЕ
МЕТОДЫ ОБЕСПЕЧЕНИЯ НАДЕЖНОСТИ
СЕЛЬСКОХОЗЯЙСТВЕННОЙ ТЕХНИКИ
КОМПЬЮТЕРНОЙ ГОЛОГРАФИЕЙ**

Аннотация. В статье рассмотрены аспекты розглянуто аспекти обеспечения надежности сельскохозяйственной техники конструктивно-технологические методами при реализации контроля их применения компьютерной голографией. Приведены примеры голограмм, которые показывают на возможности реализации неразрушающего контроля голографией.

Ключовые слова: сельскохозяйственная техника, компьютерная голография, навагрузканя, виборка, интерференционная смуга, технологический процесс.