The concept of constructing system for adaptive-selective assembly manufacture of optical devices

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Abstract: It is proposed to develop a system design and manufacture of optical instruments, covering the calculation of optical systems, engineering, technological production preparation and production of devices. The basis of the method is expected to lay the adaptive-selective assembly as a system of constructing the model development of scientific and technical product at all stages of problem solving with absolute ensuring an integrated approach.

1. Personnel

In the selection of artists, one can assume that this must be qualified; that during the execution of work will know for yourself is something new, have the opportunity to summarize the results for use in their research and dissertation work. These should be people with a wide scope of expertise in optical-mechanical instrument, but having a narrow specialization in a specific scientific applications. This should be a small group of artists united by the idea of solving this problem and working in a team. This team should include experts on the calculation of optical systems, design, technology and automation. However, the focus in the work of specialists is due to the necessity of solving the problems of assembly and adjustment. It is based on the rationality of assembly operations, should be considered the work of each artist.

Summary statement of the problem and their management should be entrusted to the staff of scientific institutes, which will provide the theoretical and scientific research base.

2. The Scientific Basis

The key point for the project is to use existing and develop new scientific and theoretical basis. The current theoretical model of the AFM (1) must be significantly revised and expanded, especially in terms of distribution of its provisions to all such directions. In addition, should be formulated a theoretical tool and a mathematical model to assess the quality of products during assembly and alignment of operations of specific products.

3. Laboratory facilities

A major problem in the performance of work is the selection and use of laboratory and stand equipment. It must meet the requirements of rationality and adaptability to specific tasks. This requires an analysis of existing laboratory facilities, the necessary modifications and upgrades. You may need to develop new original stands and test alignment devices.

4. Industrial base

When the work is necessary to consider features of current processes, design and build products. It should be taken into account the existing material resources, staff qualifications, as well as machines and equipment used in optical-mechanical industry.

5. Specific proposals

5.1. Successful implementation of the project depends on the degree of elaboration of the applicability of AFM in various applications of optical instrumentation. Conceptuality integrated approach must be implemented through a single-level organizing. As the basis of the project appropriate to use the work of Dr. Tsohera. It should also be a major focal point in the project.

5.2. As the object for constructing a system for the field of AFM optical-mechanical instrument are invited to choose microobjectives, which complement microscopes. Technical and consumer properties of lenses fully meet the specific requirements for high-precision opto-mechanical products. Microobjectives can serve as basic elements for constructing a model of the AFM for this field of technology.

5.3. Undoubtedly, the main aspect in the construction of the system in the development of AFM microobjectives is the calculation of optical systems. By calculating mean systematization of optical lens elements according to some formal features. Need to develop theoretical foundations and set the tolerances for the manufacture of individual optical components (single and cemented lenses). You must assign a theoretically grounded dimensional tolerances of the radii of curvature, thickness, diameter of the lens, as well as decentering and others should also develop a method comparison of the calculated aberrations of individual lenses and actually produced. To do this, select one of the methods for evaluating the estimated image quality of optical systems. Interference method or the method of interferograms used today in practice is time

consuming. Methods of frequency analysis and measurements of relative illumination in the center of the diffraction kernel (the number of Strehl) - are less effective because of the presence of significant aberrations in the individual elements and components of the lens. Therefore, it might be a method for assessing the components of the image of the diffraction point (a priori known that the majority of the individual elements have the plane in which at refocusing aberrations are minimal). Images of the diffraction points will look like the kernel and several rings around (the presence of residual spherical aberration of the ring may have gaps and be non-concentric (which is possible in the presence of coma, astigmatism, etc.)). This image can be successfully formalized with the help of computers.

Also, a diffraction image analysis tool point can be successfully applied in assessing the current quality and picture quality actually manufactured lens (2). To implement such an approach should be based on theoretical propositions to develop an algorithm and software to ensure that the mathematical modeling of the ideal image of the diffraction point, and comparing it with similar images obtained with the help of a real lens. The lens can be considered fit if the geometric dimensions and shape of the real and the ideal image of the diffraction points are identical. The development of this method may be to create a similar model that takes into account the real and the ideal distribution of illumination in the image of the diffraction point.

Requires the creation of the laboratory stand, which includes a tripod with a microscope, SSc camera and computer.

5.4. Second important aspect is the creation of mechanical designs that provide the necessary accuracy when mounting the individual lenses and optical components in a frame, as well as during assembly of the lens in general, when the opto-mechanical components are located on each other in a specific calculation procedure. In the process of design must take account of the methods and techniques of alignment, which will be used for final assembly of the lens.

It is assumed as the main, use the method inserts the lens in the rim with the subsequent combination of the optical axis of the lens with the mechanical axis of the frame by the method autocollimation. It is necessary to develop a mathematical model of the system of quality control resulting optical-mechanical unit. You have to understand what options are subject to unconditional control and by what methods and means of measurement. For discussion are invited to measure the following parameters:

- Accuracy of combining optical and mechanical axes of lenses and frames,
- Deviation from cylindricity frame,
- Deviation from perpendicularity of the end face on the outer rim of the cylinder,
- Measurement of the vertex segments, axial dimensions of frames and "shooter"
- Other variables defined in the field of drawing.

By the aspect of design can also include the development of techniques and creating the necessary control and alignment fixtures and stands for testing of individual opto-mechanical assemblies and lenses in general.

Using the AFM can afford not only to the classification and systematization of individual mechanical components and opto-mechanical components, but also to structure their applicability in the lenses of different class. In addition, it is possible to justify the application of any control devices for their manufacture and assembly.

Work on creating benches should begin with an analysis of design types of lenses for microscopes.

5.5. The third factor influencing the results of manufacturing lenses, providing a technological process. In this case the resulting picture quality real manufacturer of the lens should be as close to the calculated quality. The degree of aberration correction, which is set in the calculation of optical circuits, but also ensures control and adjusting stands and equipment, determines the level of technology of any production, employment, production of lenses. If a technological preparation to understand the level of its equipment with special devices, or other measuring instrument, the existence of the park standard and optional equipment for machining and assembly, in this context, the use of AFM can afford to optimize their nomenclature and structure.

As an example, the following considerations. Recently, there has been a tendency for the manufacture of most elements of modern lenses is not possible in large quantities at a time (on the block). Already at the stage of optical calculation is obvious that many lenses will be manufactured "individually" by a single technology. This means that one machine is configured to produce one "his" parts. Thus, the manufacturer of lenses for medium-strength lens is required conditionally 5-6 machines. Obvious problem of systematizing the use of certain types of machines for the manufacture of certain types of parts.

Work on the technological part should begin with an analysis of typical technological processes and organizing tools and equipment currently in use on optical businesses.

5.6. The fourth factor is the information support of construction and technological design, which should be considered as a means of ensuring high quality design work.

In the information management tools should be included system analysis and synthesis of technological systems assembly and manufacturing of parts. Consequently, be established intellectual jobs designer and technologist.

Workstations should include original and licensed software applications.

In the methodological basis of the original software should include a unified design solutions.

6. Conclusion

This document reflects the technical concept in the construction of the AFM for the process of manufacturing optical devices. As a result of the work should be a model reflecting a holistic approach in scientific and applied aspects of the organization of work. Scientific innovation could consist in the fact that the first principle of AFM is used to systematize the optical calculations, engineering design and related technological design, it allows you to automate the process of assembling products and substantially reduce the cost of production of individual elements of items (3). The practical use of the project can be expressed in the introduction of a comprehensive principle of AFM in a specific manufacturing opto-mechanical devices.

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