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# Improving the accuracy of CNC lathe group by improving the design of their components and upgrading control systems

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In Message to the people of Kazakhstan, the first President of Republic of Kazakhstan, Leader of the Nation - Yelbasy Nursultan Nazarbayev said: "Humanity is on the threshold of the third industrial revolution, which changes the very concept of production. Technological discoveries are fundamentally changing the structure and needs of global markets. We live in a completely different technological reality than before. Digital and nano technologies, robotics, regenerative medicine and many other achievements of science will become a common reality, transforming not only the environment, but also the human being. We must be active participants in these processes."/1/

During the formation of technology, special attention is paid to the issues of accuracy, the formation of engineering and manufacturing automation are connected with the constant hanging of the accuracy of processing machines. With the widespread introduction of CNC machines, the difficulties of supplying the necessary properties of the parts processed on them come to the fore.

One of the main factors determining the accuracy of machining on CNC machines is the operation of the main motion drive, which provides the cutting speed. In lathes, determining the cutting speed is the rotation of the spindle bearing the workpiece. In case of deviations of the design parameters of the drive elements of the main motion of the above function is violated, which leads to inaccurate processing of parts, failure of the machine, etc. the Study of the causes of deviations in the operation of the drive of the main motion is an urgent task at the moment.

The subject of the study is the drive of the main motion with a set of kinematic interconnected elements of the CNC lathe. Object of research: the process of control and control of oscillations in the kinematic circuits of the drive of the main movement of the CNC lathe in order to optimize the processing errors on it parts.

The purpose of this study is to analyze and substantiate the design parameters of the drive elements of the main motion of CNC machines.

To achieve this goal, it is necessary to solve the following tasks of the study:

1. Improving the technical level of machines due to reasonable technical characteristics, reasonable level of automation, advanced technical solutions and testing of structures.

2. Develop a technique that allows to determine and compensate for static and dynamic errors affecting the accuracy of the Executive bodies of the CNC lathe;

3. To calculate the design parameters of the drive elements of the main motion of the CNC machine.

4. Analysis and evaluation of the results of the experimental study and their comparison with the theoretical model.

*Technological precision machining on CNC machines and the role of the main drive.*

The main drive system of the machine is the main source of energy necessary for the implementation of the working process of cutting metals. The main drive system transmits and receives the greatest loads at high speeds of its elements and links. To ensure the reliability of the machine, this system must have high strength at both constant and variable loads. To ensure stable cutting under intensive conditions, high accuracy of processing, this system must have significant rigidity in static and dynamic modes. The main drive system shall not be excessively metal-intensive and shall provide a wide range of speed variation, and this variation shall be stepless. The complex of various and contradictory technical requirements for the main drive systems sets the task of calculating the dynamic characteristics. Knowledge of the dynamic characteristics allows you to correctly assess the load acting in the main drive system, and select the design parameters of the system so as to limit these loads to specified limits. Also, this knowledge is necessary for the correct assessment of the impact of the cutting process on stability, since this system is an element of a closed dynamic system of the machine. When calculating the main drive system, the main attention is paid to torsional vibrations in stationary periodic modes due to the periodic nature of the change in the moment of cutting force, errors in the manufacture of gears, installation errors of gears.

CNC machine is a complex dynamic system in which the accuracy of the workpiece depends on a number of factors that are formed in the subsystems, nodes, parts and elements. The study of precision machining on CNC machines is largely based on previous studies of processing errors, which investigated a

number of errors for both universal machines and machines with numerical control.

In particular, the elastic deformations of the technological system "machine - tool - tool - part", which make up a significant part in the balance of errors in the manufacture of parts, are considered in the works.

Subsequent studies and their results, given in the work showed that the technological accuracy of processing on the machine is determined by: geometric and kinematic accuracy of components and chains of machine drives; errors introduced by the cutting tool due to wear and blunting of the cutting edge of the tool; elastic deformations of the entire technological system; errors of adjustment and installation on the size of the CNC system; temperature deformations.

As a result of the accumulated experience, a classification of errors of parts is developed, which, depending on the characteristics under consideration, are divided into: systematic and random, stationary and non-stationary, dynamic and kinematic, shape and roughness errors, errors inherent in the mechanical system, the CNC system and the electric drive control system, the errors of the feed drive and the main motion drive.

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