INCREASING THE ACCURACY OF CNC MACHINES BY CORRECTING THEIR ERRORS

Matkarimov Behzod Baxtiyorjon o'g'li
Assistant , Fergana Polytechnic Institute
matkarimov.behzod@gmail.com

ANNOTATION

This article explores the structure of modern cnc machines, the areas of use of cnc machines, the errors that occur in them. The origins of errors and ways to solve these problems are highlighted.

Key words: CNC, machine, material, manufacture, machine parts, operation, CNC system.

The accuracy of the work of CNC machines is affected by a whole range of errors, which can be divided into two groups:

a) initial errors of the machine;

b) errors arising during its operation.

The initial errors of CNC machines are formed at the stage development of their layout and design, selection of materials for machine parts, as well as in the process of their manufacture and assembly.

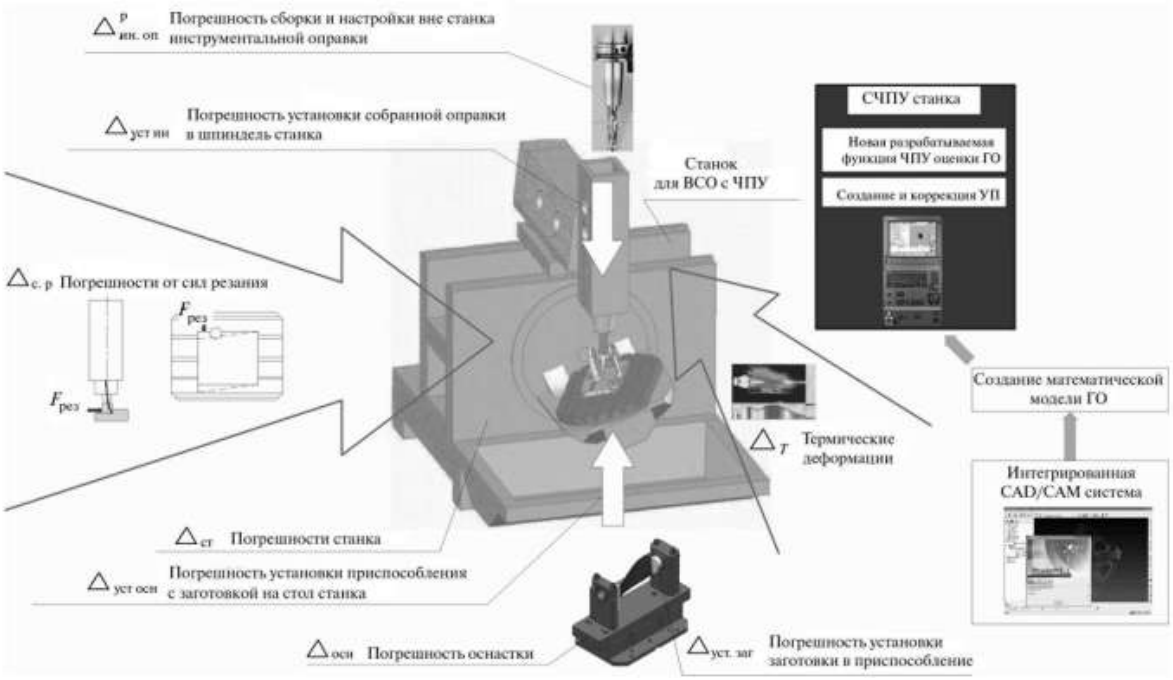

Fig. 1

During the operation of CNC machines, additional errors arise from elastic deformations due to the action of cutting forces, from temperature deformations of the basic parts and units of the machine, as well as due to the wear of various machine interfaces (guides, bearings, gears, lead screw-nut, etc.). All of the specified CNC machine tools, machine errors can have different values, act in different directions and, therefore, differently affect the output parameters of the machine tool accuracy [1-6] .

The considered errors of CNC machines can lead, in aggregate, to relative linear and angular displacements of the working bodies of the machine, carrying the cutting tool and the workpiece.

By their nature, errors arising in the machine can be systematic and random. Systematic errors are characterized by their predictability, constancy of magnitude and the nature of their change during the operation

of the machine. These errors can be measured in advance and know the nature of their influence on the accuracy of the machine. The situation is more complicated with random errors, the magnitude and nature of the manifestation of which are constantly changing, therefore, to determine them, a constant determination of their magnitude and the nature of actions on the output parameters of the accuracy of the machine is required [7-12].

Errors of CNC machines during operation are formed more intensively than in conventional machines. This is due to the more intense operation of these machines, their more significant energy consumption and greater loads on their nodes [13-19].

In general, two different, but complementary directions for increasing the accuracy of CNC machines can be distinguished:

1) preventing or reducing the possibility of errors occurring;

2) correction of existing and arising in the process of operation errors.

The first direction consists in a targeted and economically justified impact on the development, manufacture, assembly and operation of a machine tool and a CNC system, as well as impact on disturbances acting on a CNC machine during its operation (see Fig. 1). This direction, which is still more preferable, lies in the rational design of the layout and construction of all units and mechanisms of the machine, the choice of modern materials, the precise manufacture and assembly of machine components, the choice of modern drives and measuring systems, as well as in the subsequent rational operation and maintenance of the machine. with CNC.

However, this direction of increasing the accuracy of CNC machines (especially high accuracy) is associated with a large investment of money and time. On the other hand, the resistance of a CNC machine, inherent in its design and manufacture (rigidity, vibration and thermal stability, wear resistance), to the action on it during operation of internal and external factors (cutting forces, heating of parts and assemblies, wear of mates, aging of base parts, etc.) has certain limits, as a result of which the long-term preservation of the initial accuracy of the CNC machine is not guaranteed [20-25].

Carrying out periodic adjustments of mates and units of the machine or making the necessary amendments to its operation using previously existing methods has limited capabilities and does not allow to completely correct the resulting errors in the output parameters of the machine. On the other hand, their implementation leads to long downtime of expensive technological equipment.

Currently, thanks to the development and implementation of modern microprocessor-based CNC devices with a large memory capacity and high speed, adjustable high-speed feed drives of the working bodies of the machine tool, mechanisms for micromovements, various types of power supplies, the second direction of increasing the accuracy of the output parameters of CNC machines by measuring machine errors and their subsequent correction. In this case, it is not the maximum isolation of the CNC machine from the action of internal and external influences, not the desire to create "ideal" units and mechanisms of the machine, but their interaction with the environment and working environment, taking into account the variability of the operating conditions of the CNC machine [26-30].

Both of the considered ways of increasing the accuracy of CNC machines in practice should complement each other. The maximum possible reduction of the errors of the CNC machine in the first way allows then to increase the efficiency of the second way, when the systems of correction of errors of the machine are applied.

In general, there are two possible ways to correct the errors of CNC machines and to improve the accuracy of their output parameters:

1) by absolute stabilization of the working bodies of the machine, carrying the cutting tool and the workpiece, relative to the specified positions;

2) by relative stabilization, when the spatial position of one of the working bodies of the machine is changed relative to the other.

The implementation of the considered methods for correcting errors of CNC machines in full with linear and angular displacements of the working bodies is very difficult and is practically not used yet. The existing work on error correction of CNC machines partially solves these problems. In most cases, methods of correcting errors of CNC machines are considered and applied by linear displacements of the working bodies of the machine along controlled coordinates (or by turning a controlled rotary table) using the exact (with a discreteness of 0.001 mm) of the servo drives of the feed of these working bodies. Correction of the angular displacements of the working bodies is of particular difficulty.

Correction of errors of a CNC machine tool consists in the fact that in one or several constituent blocks, the summation of the initially specified information about the movement of the working bodies of the machine tool with information about its corrected errors is carried out. Therefore, in practice, the error correction of a CNC machine can be performed:

- impact on the UE, when it is predistorted on the basis of pre-calculated or experimentally determined information about the errors. This method is rarely used today;
- influence on the control signals generated by the CNC device and transmitted to the feed drives of the working bodies of the machine;
- introduction into the CNC machine of special corrective elements or actuators with micro drives and their subsequent control from the CNC system.

In the last two cases, the so-called software method of error correction is used, based on the control of the correction processes according to a given program using the CNC system.

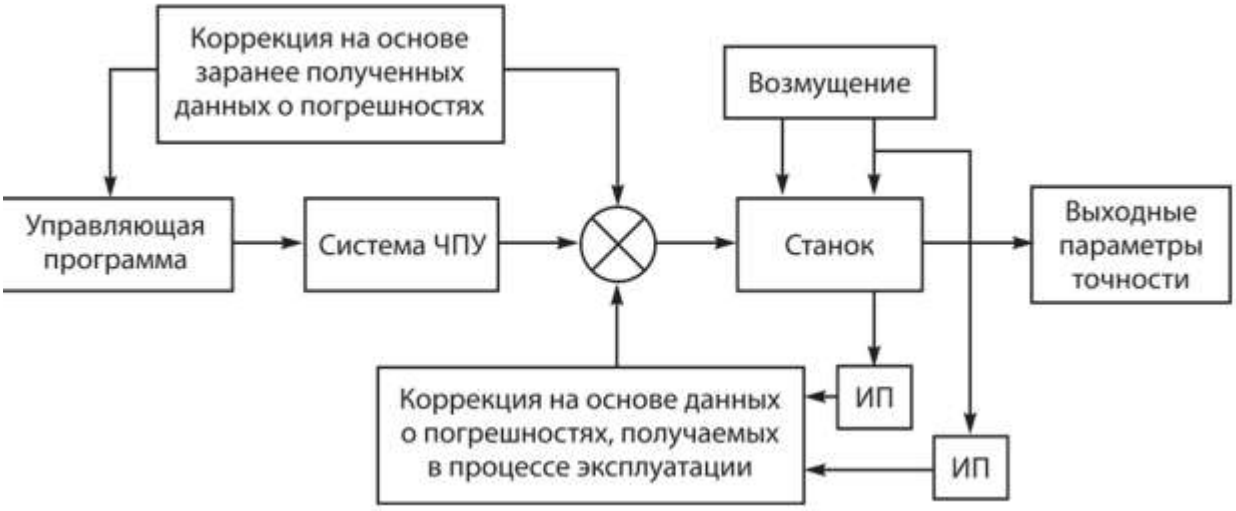

Fig. 2

The automated method for evaluating the processing accuracy developed at the department will expand the functionality of modern CNC systems, increase the processing accuracy by conducting complex software predistortion control program, taking into account the proportion and nature of the influence of individual elements of the technological system, to reduce the time of static adjustment of the machine with CNC for the manufacture of parts.

LITERATURES

1. Маткаримов Б. Б. У. МОДЕРНИЗАЦИЯ ФРЕЗЕРНЫХ СТАНКОВ С ЧПУ //Scientific progress. – 2021. – Т. 2. – №. 6. – С. 142-149.
2. Файзиматов Ш. Н., Маткаримов Б. Б. У. Автоматизация назначения режимов обработки и интегрирование конструктивных параметров комбинированного импульсно-ударного центробежного раскатника с системой Компас 3D //Academy. – 2016. – №. 7 (10).
3. Omonov A. A. O. G. L. CHUQUR TESHIKLARNI PARMALASH //Oriental renaissance: Innovative, educational, natural and social sciences. – 2021. – Т. 1. – №. 9. – С. 91-96.
4. Mamirov A., Omonov A. APPLICATION OF VACUUM CAPTURING DEVICES IN MECHANICAL ENGINEERING //Интернаука. – 2020. – №. 42-2. – С. 73-75.
5. Omonov A. A. O. G. L. HAVO YOSTIQLI KONVEYERLARNING FIK NI OSHIRISH //Scientific progress. – 2021. – Т. 1. – №. 6. – С. 967-971.
6. Akramov M. M. METALLARNI KORROZIYALANISHI VA ULARNI OLDINI OLISH SAMARODORLIGI //Scientific progress. – 2021. – Т. 2. – №. 2. – С. 670-675.
7. Акрамов М. М. ПОВЫШЕНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ СВОЙСТВ СТАЛЬНЫХ ДЕТАЛЕЙ ПРИ ПЛАСТИЧЕСКОЙ ДЕФОРМАЦИОННОЙ ОБРАБОТКЕ //Scientific progress. – 2021. – Т. 2. – №. 6. – С. 129-133.
8. Акрамов М. М. ДЕТАЛЛАРНИНГ ЮЗАЛАРИНИ КИМЁВИЙ-ТЕРМИК ИШЛОВ БЕРИШГА ҚАРАТИЛГАН ТАКЛИФЛАР //Scientific progress. – 2021. – Т. 2. – №. 6. – С. 123-128.
9. Omonov, A. A. O. G. L. (2021). HAVO YOSTIQLI KONVEYERLARNING FIK NI OSHIRISH. Scientific progress, 1(6), 967-971.
10. Файзиматов, Ш. Н., & Маткаримов, Б. Б. У. (2016). Автоматизация назначения режимов обработки и интегрирование конструктивных параметров комбинированного импульсно-ударного центробежного раскатника с системой Компас 3D. Academy, (7 (10)).
11. Маткаримов, Бехзод Бахтиёржон Угли. "МОДЕРНИЗАЦИЯ ФРЕЗЕРНЫХ СТАНКОВ С ЧПУ." Scientific progress 2.6 (2021): 142-149.
12. Omonov, Abduqahhor Abdiraxmon O'G'Li. "CHUQUR TESHIKLARNI PARMALASH." Oriental renaissance: Innovative, educational, natural and social sciences 1.9 (2021): 91-96.
13. Mamirov, Abdurashid, and Abduqahhor Omonov. "APPLICATION OF VACUUM CAPTURING DEVICES IN MECHANICAL ENGINEERING." Интернаука 42-2 (2020): 73-75.
14. Akramov, Maksadjon Muxtarovich. "METALLARNI KORROZIYALANISHI VA ULARNI OLDINI OLISH SAMARODORLIGI." Scientific progress 2.2 (2021): 670-675.
15. Акрамов, Максаджон Мухтарович. "ПОВЫШЕНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ СВОЙСТВ СТАЛЬНЫХ ДЕТАЛЕЙ ПРИ ПЛАСТИЧЕСКОЙ ДЕФОРМАЦИОННОЙ ОБРАБОТКЕ." Scientific progress 2.6 (2021): 129-133.

16. 15. Рубидинов, Ш. Ғ. Ў. (2021). Бикрлиги паст валларга совуқ ишлов бериш усули. Scientific progress, 1(6), 413-417.
17. Акрамов, Максаджон Мухторович. "ДЕТАЛЛАРНИНГ ЮЗАЛАРИНИ КИМЁВИЙ-ТЕРМИК ИШЛОВ БЕРИШГА ҚАРАТИЛГАН ТАКЛИФЛАР." Scientific progress 2.6 (2021): 123-128.
18. Рубидинов, Шохрух Ғайратжон Ўғли, and Жасурбек Ғайратжон Ўғли Ғайратов. "ШТАМПЛАРНИ ТАЪМИРЛАШДА ЗАМОНАВИЙ ТЕХНОЛОГИЯ ХРОМЛАШ УСУЛИДАН ФОЙДАЛАНИШ." Scientific progress 2.5 (2021): 469-473.
19. Nomanjonov, S., et al. "STAMP DESIGN." Экономика и социум 12 (2019): 101-104.
20. Omonov, Abduqahhor Abdiraxmon O'G'Li. "HAVO YOSTIQLI KONVEYERLARNING FIK NI OSHIRISH." Scientific progress 1.6 (2021): 967-971.
21. Маткаримов, Б. Б. У. (2021). МОДЕРНИЗАЦИЯ ФРЕЗЕРНЫХ СТАНКОВ С ЧПУ. Scientific progress, 2(6), 142-149.
22. Файзиматов, Шухрат Нумонович, and Бехзод Бахтиёржон Угли Маткаримов. "Автоматизация назначения режимов обработки и интегрирование конструктивных параметров комбинированного импульсно-ударного центробежного раскатника с системой Компас 3D." Academy 7 (10) (2016).
23. Omonov, A. A. O. G. L. (2021). CHUQUR TESHIKLARNI PARMALASH. Oriental renaissance: Innovative, educational, natural and social sciences, 1(9), 91-96.
24. Mamirov, A., & Omonov, A. (2020). APPLICATION OF VACUUM CAPTURING DEVICES IN MECHANICAL ENGINEERING. Интернаука, (42-2), 73-75.
25. Akramov, M. M. (2021). METALLARNI KORROZIYALANISHI VA ULARNI OLDINI OLISH SAMARODORLIGI. Scientific progress, 2(2), 670-675.
26. Nomanjonov, S., Rustamov, M., Rubidinov, S., & Akramov, M. (2019). STAMP DESIGN. Экономика и социум, (12), 101-104.
27. Рубидинов, Ш. Ғ. Ў., & Ғайратов, Ж. Ғ. Ў. (2021). ШТАМПЛАРНИ ТАЪМИРЛАШДА ЗАМОНАВИЙ ТЕХНОЛОГИЯ ХРОМЛАШ УСУЛИДАН ФОЙДАЛАНИШ. Scientific progress, 2(5), 469-473.
28. Акрамов, М. М. (2021). ДЕТАЛЛАРНИНГ ЮЗАЛАРИНИ КИМЁВИЙ-ТЕРМИК ИШЛОВ БЕРИШГА ҚАРАТИЛГАН ТАКЛИФЛАР. Scientific progress, 2(6), 123-128.
29. Акрамов, М. М. (2021). ПОВЫШЕНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ СВОЙСТВ СТАЛЬНЫХ ДЕТАЛЕЙ ПРИ ПЛАСТИЧЕСКОЙ ДЕФОРМАЦИОННОЙ ОБРАБОТКЕ. Scientific progress, 2(6), 129-133.
30. Рубидинов, Ш. Г. У., & Ғайратов, Ж. Г. У. (2021). КЎП ОПЕРАЦИЯЛИ ФРЕЗАЛАБ ИШЛОВ БЕРИШ МАРКАЗИНИНГ ТАНА ДЕТАЛЛАРИГА ИШЛОВ БЕРИШДАГИ УНУМДОРЛИГИНИ ТАХЛИЛИ. Oriental renaissance: Innovative, educational, natural and social sciences, 1(9), 759-765.
31. Рубидинов, Ш. Ғ. Ў., & Акбаров, К. И. Ў. (2021). МАШИНАСОЗЛИКДА СОЧИЛУВЧАН МАТЕРИАЛЛАРНИ ТАШИШДА ТРАНСПОРТЕР ТИЗИМЛАРИНИНГ АҲАМИЯТИ. Scientific progress, 2(2), 182-187.