Automated System for Predicting the Error of CNC Machines

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Abstract: A well-known postulate of mechanical engineering technology is – if the part cannot be processed on this machine with the required accuracy, then you should either use a different precision machine, or increase the accuracy of this machine.

Keywords: metal cutting machines, CNC machines, machining accuracy, correction error compensation, automated forecasting system, error of CNC machines.

Introduction

The practice of modern production of aircraft and rocket technology products shows that processing a single body part on a CNC machine can take tens or hundreds of hours. At the same time, the duration of the technological transition, taking into account the wear of the cutting part of the tool, for example, for end carbide cutters of small diameters (up to 20 mm), should not exceed 45 minutes, and taking into account modern technologies for improving tool durability – up to 450 minutes without losing cutting productivity. Continuous operation of the machine inevitably leads to thermal deformations of the elements of their load-bearing systems and temperature errors, the reduction of which is implemented by various automated systems, some of which are reviewed in the first section of the work. It was shown that all systems of compensation (or correction) of temperature errors of machine tools according to the basic technologies of their implementation can be divided into three types.

Discussion And Results

The first type of systems provides a preliminary analysis of the thermal behavior of the machine and the construction of regression models for coordinate movements of the spindle. Such systems, for example, are implemented in NPO machines "Stankostroenie" (produced in Russia, Sterlitamak), Okuma (produced in Japan). The second type of systems uses technologies for controlling heat-active elements that implement some physical and technical effect, located in the machine structure. Such systems, for example, along with the systems of the first type are implemented in the machines of Kitamura (manufactured in Japan) and Mitsubishi. The third type of system uses OMV technologies (OMV - On Machine Verification), built on automated part measurement systems installed on the machine.

OMV technologies were used in the implementation of full-scale thermal experiments on a multi-purpose CNC machine equipped with a contact measuring system based on the TS50 measuring probe of the German company Blum-Novotest GmbH. The accuracy indicators of the used measuring system, as well as the convenience of its use on a machine operating under load, allowed us to consider its use in an automated system for correcting the temperature error of a CNC machine.

Many modern CNC machines are equipped with similar measuring systems, and due to their low cost (relative to the cost of a CNC machine – the cost of these systems does not exceed $

10,000), they can be additionally equipped. This creates a fundamentally new opportunity to improve the accuracy of machining for a huge fleet of CNC machines at a low cost, not exceeding 5 % of the total cost of the machine.

Depending on the control tasks to be solved, algorithms for the functioning of control systems, or goals to be achieved, there are: stabilization systems, software control systems, and tracking systems.

Stabilization systems are designed to maintain a constant level of output parameters.

Software control systems are designed to change output values in accordance with a pre-defined program.

Tracking systems are designed to reproduce driving forces that obey a previously unknown law of functioning.

The structure of the machine tool temperature error prediction system (Figure 1) includes five main blocks: a block for setting a cyclogram; a block for generating field test results; a block for calculating the temperature error; a block for predicting the temperature error; and a visualization block.

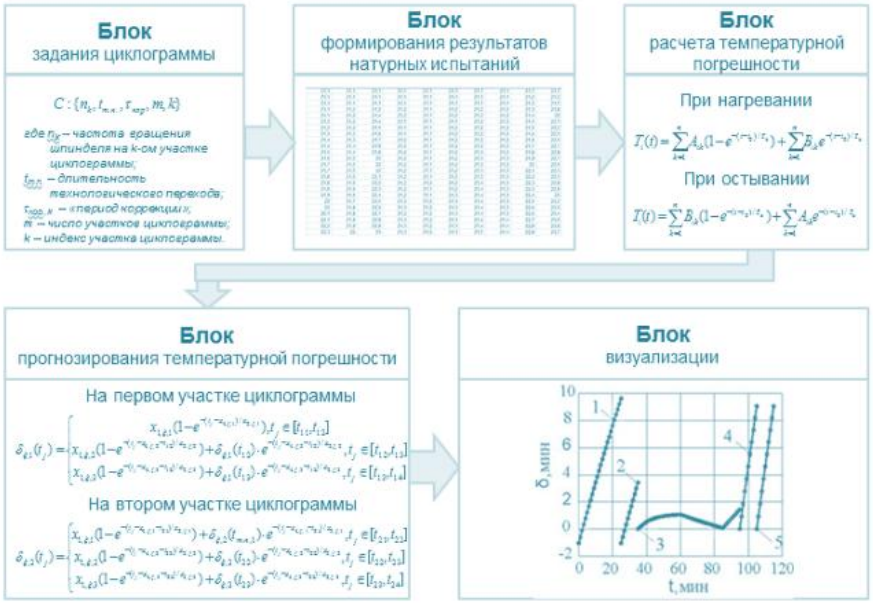

Figure 1-Structure of the automated system for calculating compensating impacts

Conclusion

Based on the basic provisions of the theory of thermoelasticity and the results of field experiments, the assumption of the condition on the linear relationship of temperature movements of the working elements of the machine with temperature was justified.

An automated system for calculating compensating effects aimed at reducing the temperature error of a CNC machine has been developed. This system is designed to support the decision-making of a technology engineer when developing a control program for CNC machines of the machining center type (drilling, milling and boring group).

List of literature:

1. Ygli Ylmasov A. A. et al. Zamonaviym ашинасозлик damashin a sozlikdaavtomo biloinalariningaamiyati / /Science and Education. - 2021. - Vol. 2. - no. 5. - pp. 390-394.

2. Matkarimov B.B.U., Ulmasov A.But.Ў. IMPROVED TO ЧНОСТИMACHINING ACCURACY ON MILLINGMACHINESS ChPU / / Academic research in educational sciences. - 2021. - Vol. 2. - no. 12. – P.1367-1371.
3. Fayzimatov S. N., Gafurov A. M. THE IMPORTANCE OF AUTOMATION IN THE DESIGN OF SHAPED SURFACES //Scientific progress. – 2021. – Т. 2. – №. 6. – P.1564-1570.
4. UlmasovA.But.Ў., Ismoilov About. H.Ў. ШТАМЛАРНИИШЧИАСБОБЛА РИНИБАРҚА РОРЛИГИНИТАЪМИНЛАШМАСАЛАЛАРИ //Scientific progress. – 2021. – Т. 2. – №. 1. – Pp. 913-917.
5. Fayzimatov S. N. ENCREASING OF EFFICIENCY OF CUPTURE INSTALLATION ON AUTOMATIC MANIPULATOR //Actual problems of modern science. – 2011. – №. 1. – P. 192-194.
6. Ulmasov A. A., Abdukhakimov N. Zh. Process and experiment of friction drilling //Science and education. - 2021. - Vol. 2. - no. 5. - pp. 335-342.
7. 7.Fayzimatov S. N., Tojiyev B. A., Jo'rayev S. D. METHOD OF IMPROVEMENT IN THE PROCESS OF STRETCHING NON-FERROUS METAL WIRE //International Scientific and Current Research Conferences. – 2021. – P.51-57.
8. UlmasovA.But.Ў., Ismoilov About. H.Ў. Штампларб арқарорлигиниоширишитиқб оллари //Scientific progress. – 2021. – Т. 2. – №. 1. – Pp. 924-928.
9. Todjiboyev R. K., Ulmasov A. A., Sh M. 3M structural bonding tape 9270 //Science and Education. – 2021. – Т. 2. – №. 4. – P.146-149.
10. Fayzimatov Sh. N.,Matkarimov B. B. U. Automation of the assignment of processing modes and integration of design parameters of a combined pulse-shock centrifugal roller with the Compass 3D system / /Academy. – 2016. – №. 7 (10). – P. 12-16.
11. Fayzimatov Sh. N. et al. KICHIKIRGA EGA BYLGAN CHUKUR TESHIKLARNI DORNALAR YERDAMIDA ISHLOV BERISHDA YUZA ANIKLIGINI OSHIRISH / /Science and Education. - 2021. - Vol. 2. - no. 3. - pp. 181-187.
12. O'Lmasov Ahadjon Akramjon O. G. et al. New approaches in the diagnosis and monitoring of rotor oscillations using shaft sensors //Science and Education. – 2020. - Vol. 1. - no. 1. - pp. 158-166.
13. Matkarimov B. B. U. Modernization фрезерных of CNC milling machines ЧПУ/ /Scientificprogress– - 2021. - Vol. 2. - no. 6. – P.142-149.
14. Matkarimov B.B.U., Ulmasov A. But. Ў. MODERNIZATION OF THE DEEP500 With CNC under SPECIFICE-TASKS / / Academic research in educational sciences. - 2021. - Vol. 2. - no. 12. – P.1384-1390.