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ANALYSIS OF THE DETERMINATION OF THE CRITERIA FOR THE EROSION OF TURNING TOOLS IN PRODUCTION

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Abstract
At present, much attention is paid to the improvement of technological machining, increasing the accuracy and efficiency of processing machine parts, and increasing tool wear. The use of high-performance machines in small-scale production, traditional automation (turret, modular, single and multi-spindle machines and automatic lines) is almost impossible, since the cost of machines is very high, and the initial setting of the machine load is very large. One of the main directions of automation of workpiece processing processes in small-scale and serial production is the use of machine tools with digital program control.

Keywords: CNC, process, cutting tool, time, cost, intensive, detail.

Introduction

The goal of the action strategy for the development of the Republic of Uzbekistan for 2017-2021 is to further increase the effectiveness of ongoing reforms, increase the level of development of the state and society, liberalize all spheres of life, and implement the most important priorities of modernizing our country.

The Action Strategy is being implemented in five stages, providing for the adoption of state programs for each year, based on the names that will be assigned to the years in the country in the next five years.

Currently, in order to speed up production processes, increase their efficiency and ensure the competitiveness of manufactured products in the world market, engineering enterprises require an increase in the accuracy of process equipment and its large-scale automation.

The continuous development of science and technology leads to a frequent change in types of products at engineering enterprises, a reduction in the time for mastering new products due to a change in production capacities. This is especially evident in the assembly processes. The assembly of machines, equipment, mechanisms, technological equipment is the final stage of the production process. At this stage, their technical detail and quality are ensured. This, in turn, requires a lot of effort to complete the assembly work.

Materials and Methods

The most advanced method is to determine the wear criterion of a turning cutter by vibroacoustic method, but this gives the designer various possibilities. Of course, in any

mechanical method, two rigid bodies collide with each other. One is the cutting tool and the other is the workpiece. Apparently, there is directly useful work going on here.
Any of our cutting tools can lose their stability after a certain time, i.e. the obstruction also deviates from the state. This is the so-called cutter corrosion problem in the machine building industry. Of course, using vibroacoustic signals to eliminate this problem is a good way. Using this method, it is easier for us to find out the period of operation of our cutter and the (signal) sounds it emits based on specific facts, one of the main directions for automating the processes of machining workpieces in small-scale and mass production is the use of machine tools with digital program control (DPC). Of course, when using CNC machines, it is of great importance to control the events taking place in the cutting zone and to diagnose the process based on them. Therefore, we analyze the process of generating vibroacoustic and electromagnetic signals that are generated during the cutting process. The process of cutting metals combines the deformation under the action of a cutting tool and the separation of the upper layer of metal. During the processing of metals, an intensive deformation process occurs in the cutting metal, as a result of which two new surfaces are formed in front of the cutting edge in the form of distortions. One is the machined surface on the part, and the other is the inner surface of the chip. When a metal is deformed, the main energy is spent on plastic deformation. The nature of the passage of this process will depend on the state of deformation (compression or friction). Deformation or distortion during compression (or tension) from all sides does not occur until a repulsive stress occurs. But with three-sided deformation in the chip formation zone, the stress will not be the same, and repulsive stress will always be created. Which determines the deformation, which carries the basic information for diagnosing the formation of scratches. The energy consumption during metal deformation depends on the structure of the crystal lattice in the metal. Metals and alloys have basically three types of crystal lattices: side-centered, hexagonal, and body-centered. In a crystal lattice, plastic deformation occurs with slip or vibrations. In sliding, atomic crystals slide discretely along the slip plane when a certain voltage is reached, while in oscillation, one part of the crystal slides so that in the second part it seems to be the same as itself. From the above analysis, it will be possible to control and diagnose the cutting process using vibroacoustic and electromagnetic signals.
75-80% of all engineering products are produced in serial and small-scale production, these industries are characterized by a large investment of time to perform auxiliary operations. It is known that when performing technological operations in mechanical engineering, the main time is 20-30% of the total time norm, the auxiliary time is 70-80% of the total time. The main direction of reducing auxiliary time costs is the automation of production processes. However, while supporting high-performance machines in small-scale production, traditional automation (turret, modular, single and multi-spindle submachine guns and automatic lines) is practically impossible, since the cost of these machines is too high, and the laboriousness of the initial setup of the machines is too high. One of the main directions of automating the processes of machining blanks in small-scale and mass production is the use of machine tools with digital program control (CDC). Of course, when using CNC machines, it is of great importance to control the events taking place in the cutting zone and to diagnose the process based on them. Therefore, we analyse the process of generating vibroacoustic and electromagnetic signals that are generated during the cutting process.

The process of cutting metals combines the deformation under the action of a cutting tool and the separation of the upper layer of metal.

During the processing of metals, an intensive deformation process occurs in the cutting metal, as a result of which two new surfaces are formed in front of the cutting edge in the form of distortions. One is the machined surface on the part, and the other is the inner surface of the chip. When a metal is deformed, the main energy is spent on plastic deformation. The nature of the passage of this process will depend on the state of deformation (compression or friction). Deformation or distortion during compression (or tension) from all sides does not occur until a repulsive stress occurs. But with three-sided deformation in the chip formation zone, the stress will not be the same, and repulsive stress will always be created. Which determines the deformation, which carries the basic information for diagnosing the formation of scratches. The energy consumption during metal deformation depends on the structure of the crystal lattice in the metal. Metals and alloys have basically three types of crystal lattices: side-cantered, hexagonal, and body-cantered. In a crystal lattice, plastic deformation occurs with slip or vibrations. In sliding, atomic crystals slide discretely along the slip plane when a certain voltage is reached, while in oscillation, one part of the crystal slides so that in the second part it seems to be the same as itself.

The boundary between the deformed and undeformed zones is determined by the dislocation transition boundary. By the nature of the occurrence of dislocations can be helical and ribbed. An edge dislocation can only propagate over a surface, while a screw can propagate over any surface. A realistic manifestation of the deformation of materials is the formation and propagation of a dislocation under the action of stress. This process occurs simultaneously in several planes, microcracks proceed intensively and other defects of the crystal lattice appear. Thus, when the metal is deformed, the dislocations sharply increase, and the subsequent deformation becomes more difficult, which leads to the hardening of the metal.

The passage of a dislocation depends on the type of stress states, and their propagation is a physical phenomenon, that is, it can be used to diagnose the process of metal processing. Depending on the cutting conditions and the properties of the material being processed, the deformation process takes place in different ways.

The metal passes through the deformation zone at great speed. The strain rate reaches 10000-$20000^0 s^{-1}$. The above physical phenomena cause the formation of high-frequency vibroacoustic signals in the shear zone.

When cutting metals, the deformation process is discrete, so the power of the heat sources pulsates along with the sampling frequency of the deformation process. This leads to periodic fluctuations in the temperature field, but its fluctuations are one or more steps lower than the frequency of the heat source oscillations as a result of the inertia force. With an increase in the amplitude of oscillations of the cutting tool, its oscillations in the temperature field also increase.

In the process of cutting, the internal state of atoms and molecules is continuously changing. This makes them a source of electromagnetic phenomena. Considering that the any system tends to have minimal energy, metalworking removes excess energy in the form of an electromagnetic wave, with the exception of electrical energy in the contact zone of the cutting tool. As a result of plastic deformation, the atoms located near the dislocation core vibrate, forming "active centres", that is, the detachment of electrons is facilitated. As a result, individual electrons go beyond the instrument part, there is a difference in electrical potentials between the contact surfaces, which is accompanied by the generation of electrical signals.

The vibroacoustic method of monitoring the state of the cutting tool on machines with digital program control provides the correct choice of the operating frequency range, i.e., it manifests itself in a change in the amplitude of the signal from the erosion of the cutting tool. The theoretical possibility of such types of processing is still problematic, and the entire frequency range is limited by the capabilities of modern vibration sensors, which are not intelligent enough and are not equipped with self-monitoring tools. To determine the information frequency range in the audio range, a number of experiments were carried out on conventional machines and CNC machines. In studies, the depth of cut, t wear of the pushers S and N, the number of revolutions fluctuate over a wide range. Materials made from different metals with different physical and mechanical properties were used. For example: steel, brass, and duralumin. Processing was carried out by machines of the RDB type using a T15K6 cutter. The chisel has the following geometric dimensions: length 120 mm, width 10 mm, thickness 12 mm, cutting angles $\alpha=12°$, $\gamma=18°$.

Modern methods of analysis of the vibroacoustic signal of the cutting process.

At present, various methods for assessing the dynamics of complex vibroacoustic processes are used in vibrodiagnostics. For vibroacoustic analysis of the cutting process, it is advisable to use the following methods: peak factor method, direct spectrum method, envelope spectrum method.

The main advantage of the method is the determination of the beginning of the destruction of the cutting tip and the observation of the further process of its destruction. The main disadvantages are the weak noise immunity of the method and the need for constant clearances during the cutting process. When the peak ratio changes in the selected frequency range, the CNC sends a signal to the control unit to use vibroacoustic touch control and measure the dimensional absorption of the cutting tip.

The spectral method goes around. This means that the high-frequency part of the signal changes its amplitude over time, which is modulated by the low-frequency signal. This modulation may contain information about the position of the cutting edge of the cutter. Sharing and processing this information is at the heart of this method. This method gives the best results when analyzing the modulation of a non-wideband signal received from an accelerometer, but first when performing bandpass filtering of an oscillatory signal in the operating range and when analyzing the modulation of this signal. To do this, the filtered signal is determined, i.e. the modulating signal is divided (it is called the "envelope" of the signal, which is transmitted to the small-band spectrum analyzer), and the spectrum of the modulating signal or the envelope spectrum of interest is obtained. The advantages of the method are high sensitivity, information component and anti-noise element. The main disadvantage is the high cost and complexity of implementation. The application of this method also involves the transmission of a signal to the CNC machine for vibroacoustic control through vibration, followed by measurement of the dimensional erosion of the cutting edge of the cutter. To analyse the state of the cutting edge of the cutter, it is advisable to use the crest factor method, since it allows you to trace the state

of the cutting edge from the beginning of destruction to its complete destruction. This is expensive equipment that does not require an expert opinion.
According to the latest data, the share of mechanical processing accounts for 60% of the time and money spent on the manufacture of a product. Machining of metals by cutting is considered and is considered the basic method that ensures the accuracy and quality of machining parts. A significant increase in engineering output is achieved by increasing labor productivity in mechanical processing. When processing parts, the time taken to complete each process will consist of two parts:
a) main technological (or machine) time;
b) auxiliary time;
The increase in labour productivity is carried out by reducing the auxiliary and main technological (machine) time. The reduction of auxiliary time is achieved, firstly, by automating the working bodies of the machine, secondly, through the use of high-speed machine tools, and thirdly, by improving the processing process. When choosing the parameters of the cutting process, the value of data such as power, power, temperature is first indicated. In the following, we will present the results of studies in which this parameter is used to easily and quickly evaluate the process of metal processing. In this regard, we pay attention to the vibroacoustic signal (VAC), the shear zone q. In the theory of metal cutting, the choice of a vibroacoustic signal as an information parameter olganda kesib ishlash is based on the analysis of methods and means for determining the state of the cutting tool of the signal and diagnosing the cutting process as a whole, as well as the main factors. In addition, the corrosion of the cutting tool occurs as a result of friction, plastic deformation, adhesion and diffusion phenomena on the cutting surfaces, the surfaces of the cutting tool and workpieces, as well as in the process of corrosion of the tool material in the cutting zone o ' . In this case, elementary particles pass from a state with a higher energy value to a state with a lower energy value and a part of the excess energy is introduced. The change in energy in the cutting tool leads to the emergence of elastic waves and stress waves, since the friction of the falling chip on the front surface of the tool leads to the formation of cracks on the back surface of the part of the processed suitable surfaces, dislocation movement, and changes - to structural changes that pass into the contact part of the processed tool, which leads to corrosion of the cutting tool. Therefore, the resistance of the tool material to corrosion depends on the duration of these processes. When cutting metals, very small (micro) cracks appear on the contact surfaces, which primarily leads to the formation of vibroacoustic (VAS) signals. [1]
During cutting with a cutting tool, the amplitude of the oscillatory signal reaches its maximum value q , and then its value changes, it is characteristic that in the initial period of the cutting process, the vibroacoustic signal (VAS), amplitude changes are intensively delayed, and after a while they reach a stable level and a slight increase in signal amplitude is observed. The results of experiments on various tools and working metals show that the time for stabilization of the vibroacoustic signal (VAC) comes by the time the cutting tools are out of order, that is, by the time a new cutting tool is purchased. In combination with this, the amplitude time of the initial vibroacoustic signal (VAC) of the cutting tool and the material being processed is determined. q The magnitude and magnitude of the intervals defined in this and q T period will depend on the amplitude. The eatability of the cutting tool changes with each interval at the

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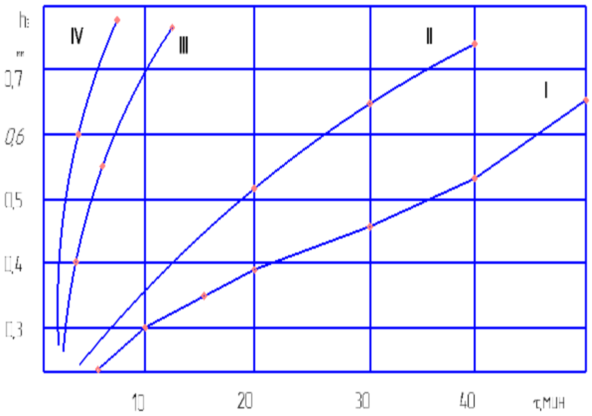
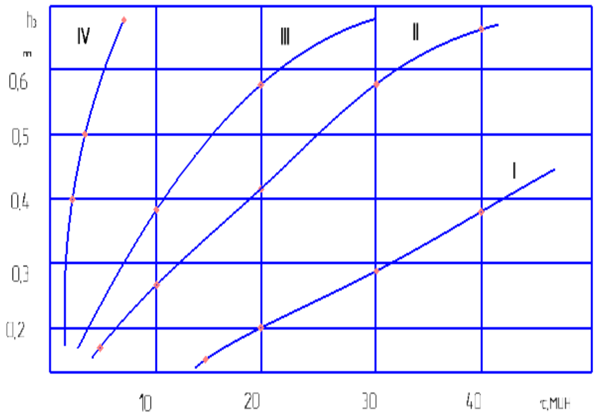
end of the interval. Thereafter, the first q q attiq alloy plate is cut within the pin surface and the first time interval, and the second surface is performed during the cutting cycle within the first flow interval and the second time interval. Thus, the end edge of the cutter is used for cutting during q T, equal to the stabilization time of the amplitude of the vibroacoustic signal (VAC) for the given processing conditions throughout the entire operation q .[2]

Figures 1 and 2 show the erosion of the rear surface of the cutting tool during the processing of alloy steel 30KhGSA with a t5k6 cutter and steel 45 with a t5k10 cutter, followed by the dependence of the amplitude of the vibroacoustic signal (VA) on the cutting time k.



1- Figure 1. Alloy steel 30xgsa
k t5k6 milling cut
Bevel of the cutting tool when processing alloy steel 30KhGSA with a cutter t5d6;
s = 0.2 mm / rev, t = 0.5 mm,
I) V = 1.92 m/s, II) V = 2.4 m/s,
III) V = 4.3 m / s,
IV) V = 4.3 m/s.



2- Figure 2. Steel
-45 cutting
processing tool
cutter t15k10 steel with = 0.1 mm / rev,
T = 0.5 mm, I) V = 2 m / s,
II) V=2.7 m/s, III) V=3.6 m/s, IV) 4.9 m/s.

Ap The next step in determining the AP osteriori parameters is usually an instantaneous assessment of the intensity of the change in the vibroacoustic signal (VAC) in the initial period of the cutting process, depending on whether the cutting tools are eaten in the cutting area q.

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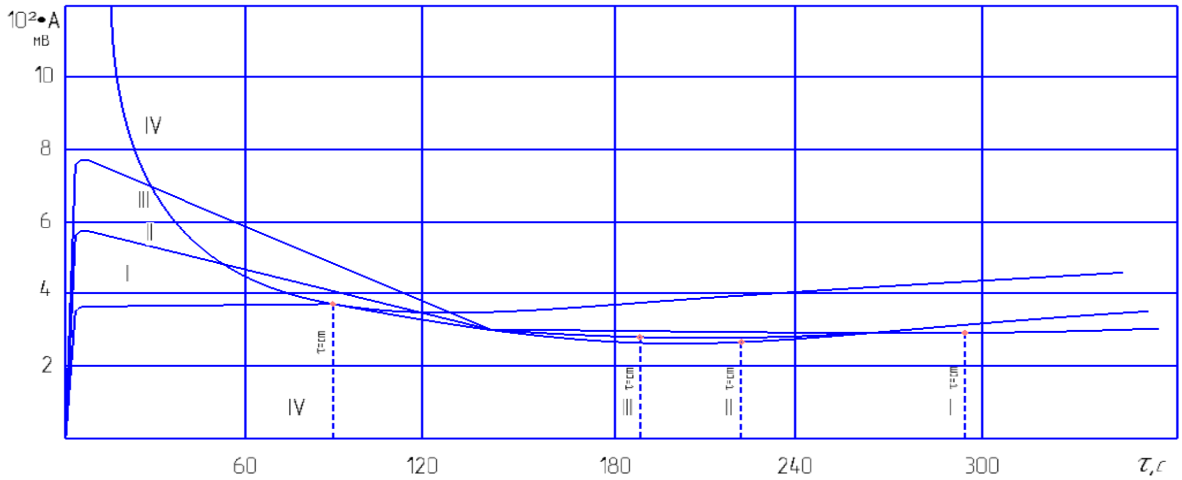

Figure 3. The intensity of the change in the vibroacoustic signal (VAS) in the initial period of the cutting process under machining conditions.

In the graphs above, i.e. in tables, a joint analysis of the wear of the cutting tool and their wear lines, changes in the amplitude of the vibroacoustic signal (VAS) over time shows that certain similarities for these dependencies exist by themselves, i.e. the period wear of the cutting tool corresponds to a change in the amplitude of the vibroacoustic signal (Vas): a slight change in the normal wear area of the edible honey plant of a high level - a significant increase in the amplitude of the measured signal can be observed. [3]

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