Features Of Machining Machine Parts On Cnc Machines Productivity And Accuracy.

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ABSTRACT

This article investigates a way to reduce the impact of working time on the processing of operator housing parts while increasing the productivity of software-controlled digital machines in the process of machine learning. Effective methods have been developed to improve the accuracy of processing by introducing additional codes into the control software.

Keywords: Machine tools with numerical control, increased efficiency, productivity, time,code.

Introduction. Numerically controlled machines are rapidly programmable technological systems that are particularly effective for automation of small and medium-scale production. The main feature of CNC machines is their technological flexibility, thanks to which a quick transition to the manufacture of new parts is carried out. The technological flexibility of CNC machines is determined by the following factors.

1. Direct specification of the dimensions of manufactured parts as the initial geometric information in the form of an array of digital data.

2. Digital assignment of the necessary technological information that determines at each of the transitions the spindle speed, the speed of working and accelerated feed, cutting depth, etc.

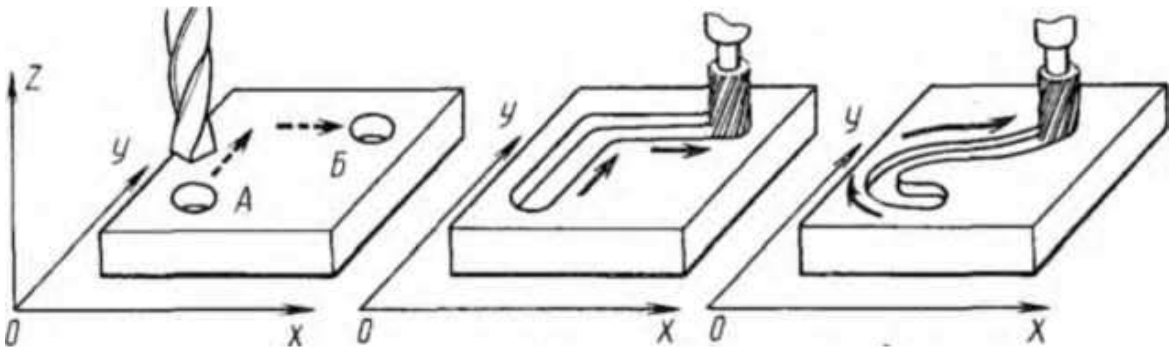
3. Automatic control of all auxiliary transitions and commands for automatic tool replacement, switching on and off the coolant, replacing and fixing workpieces, etc.

4. Implementation of the envisaged correction of the dimensional adjustment of cutting tools and cutting modes.

These basic principles of numerical control have different implementations according to the type of machine equipment, accuracy requirements and automation level.

Presentation of the main material of the article. The accuracy class of the machine does not affect the accuracy of the machining of parts, but is used for the purpose of machine tools, the size of cutters, drills, cutters. Work pieces and parts to be machined on CNC machines must be free of corrosion, burns and scale.

Technological transitions, such as drilling, countersinking or boring holes, are performed at the same time after positioning at a given point (Fig. 1, a). When controlling movements along straight segments, the cutting tool moves with the set working feed, carrying out processing on a given segment (Fig.1, b). Straight line segments are set by programming the coordinates of the end points. In this case, the movements are performed alternately in the direction of one of the coordinate axes with the control of the length of movement and speed. Such systems usually do not provide for functional coordination of movements in several coordinate directions. These systems are used on milling, turning and grinding machines.



a) b) c)

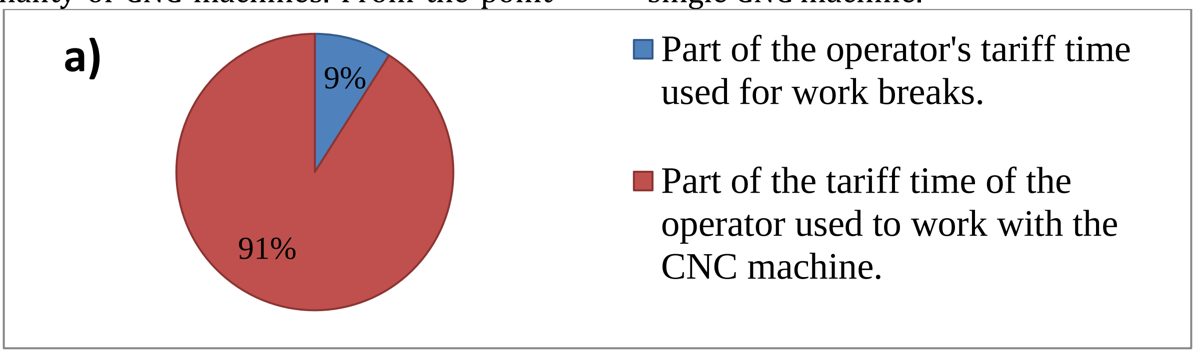
Fig. 1. Examples of solving technological problems in positional and contour control systems: a - drilling holes by programming individual points; b -milling rectilinear grooves by programming straight segments; c - milling a curved surface by programming a contour.

In contour control systems, the shaping of parts occurs as a result of simultaneous coordination of movements in the direction of several coordinate axes. At the same time, the movement of the cutting tool along the required trajectory with a given resulting speed is ensured (Fig.1, c). Thus, continuous control of movements along two, three or more controllable coordinates is provided. The program for controlling the feed drives during contour or volumetric processing is calculated in a complex based on the required shape of the part and the required resulting speed of movement. Contour CNC systems are the most complex, they are used mainly on lathes and milling machines. Combined control systems can perform the functions of both positional and contour CNC systems.

Signs of modern configuration and functionality of CNC machines. From the point of view of the design of the mechanical part of the CNC machine, during its development, attention is paid primarily to the main drive and feed drives, the measuring device and the overall layout of the machine.

Unlike "classic" machines, the main drives of CNC machines are more powerful. Drives with stepped and step less speed change are used. The main drives of CNC machines with a step-by-step speed change are usually implemented by means of gears switched by couplings (electromagnetic, gear or plate) or by means of movable gears when using a two or three-stage electric motor. The disadvantage of stepwise speed change is the difficult task of economical cutting speed, and the advantage is the low cost.

The increase in productivity is supported by carrying out operations on a single CNC machine.



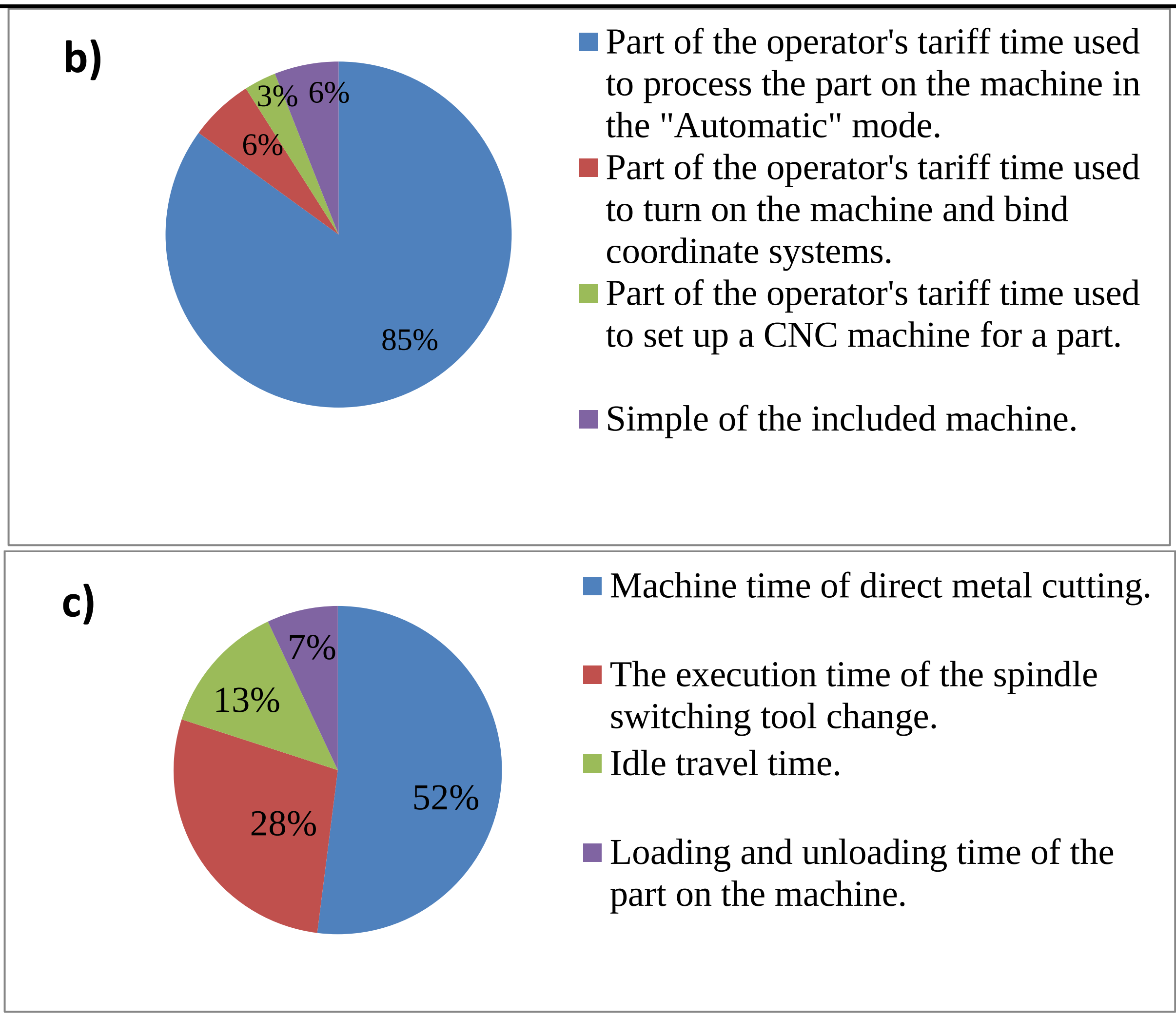


Fig. 1. Diagram of the time consumption of the "Housing" part, during machining on a CNC machine.

When processing parts on manually operated machines, there is a tendency to differentiate operations. All processing is divided into elementary, simple operations and transitions. In the process of designing parts, they strive to avoid difficult and inconvenient surfaces for processing.

The use of CNC machines makes it possible to process surfaces of any shape. Therefore, the complexity of the geometric shapes of the processed parts is not a negative factor in assessing their manufacturability, and ultimately enables designers to improve the technical and economic characteristics of products. In addition, CNC machines allow you to integrate operations.

The experience of a number of enterprises has shown that testing the manufacturability of parts to be processed on CNC machines is the most effective if it is carried out at the stage of product design.

Evaluation of the manufacturability of the design of the part to be processed on CNC machines should be made taking into account the requirements of machining and programming tasks. The latter requirement is new and essential. To simplify programming tasks, geometric images should be simplified and the main repeating geometric elements of the part should be typed. It is desirable that the processed surfaces of the part represent a plane or a curved surface, the contour of which is formed by a combination of straight lines with circular arcs.

To meet the requirements of machining on CNC machines, technological parts should be considered, the shape and dimensions of which meet the conditions for processing in a continuous automatic cycle.

If the design of the part meets the general requirements of machining and programming, then the increase in manufacturability should be aimed at reducing the standard sizes of the cutting tool required for complete machining of the part.

When working on CNC machines, it is established that the main and piece time is reduced by 50% in comparison with processing on hand-operated machines, then, despite the additional costs, a single cost reduction is maintained. The economic result can be obtained by machining elements on CNC machines, the production of which on manually operated machines is connected with the use of expensive technological devices (conductors, shaped cutting devices), time spent on setting up the technological system in comparison with operational time.

Development of the most economical sequence of manufacturing the elements of the part and preparation of the UP. Such development can be carried out by two methods: the method of modeling the processing process taking into account the experience of highly skilled machine workers, as well as the computational and analytical method.

Dimensional alignment of the tool trajectory with the coordinate system of the machine and the position of the work piece. The uniformity of the allowance distribution and the achievement of a given precision in the manufacture of parts depends on the rational solution of this problem.

Rational orientation of the work piece on the machine table. The solution of this problem depends on ensuring high machine productivity and worker safety when changing parts.

For CNC machines, recommendations have been developed to increase the overall effect of their use, taking into account the distinctive features of the design of CNC machines and microprocessors:

● it is advisable to use multi-seat mechanisms that ensure the processing of several components that are similar or different in the system;

● on CNC machines, plates with holes or grooves should be used, this reduces the time of adjustment and changeover of equipment to a new work piece; also, it protects the working planes of the table from wear.

● taking into account the time of positioning, changing the device, turning the revolver tool, the desktop can correctly calculate the sequence of hole processing (for example, when, taking into account the time spent, a number of holes are processed with a single tool, or any hole is processed with a change of cutter). First, it is recommended to perform transitions that require a higher spindle rotation frequency in absolute value.

Since CNC machines are quite expensive, progressive microprocessors should be used and more active metalworking modes should be used. It makes sense to use cutters and cutters with replaceable coated plates (even for drilling and deployment), or a tool compacted with composites.

A single recommendation when using CNC machines is the choice of optimal cutting modes, technological devices. The use of automatic equipment, various mechanisms, adaptive diagnostic devices, will significantly increase the efficiency of the use of CNC machines.

To prevent premature wear of the tool or the formation of notches on the cutters and cutters, the wear of spindle bearings, it is not necessary to install blanks on CNC machines, excessive tightening of the fastening nuts of which takes place during the loading of the material.

In serial production, it makes sense to use automatic cartridges to reduce the loading and unloading time of the work piece and the components, which will ensure a reduction in the cyclic loading and unloading time from 7 to 3%.

It has been experimentally established that the optimization of the control program code reduces the additional piece time of automatic device change, spindle speed switching from 28-10%. The technological process of processing on a CNC machine, unlike the traditional technological process, requires more detail in solving technological problems and taking into account the specifics of the presentation of information [4]. Structurally, the technological process is also divided into operations, the elements of which are installations, positions, technological and auxiliary transitions, working and auxiliary moves. With the rational design of the technological process, the probability of increasing the productivity of machines by 20%.

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