

TYPES OF WRITING CONTROL PROGRAMS FOR CNC MACHINES

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***Annotation:** This article discusses methods for creating a program for processing parts on computer numeral control machines used in mechanical engineering and manufacturing enterprises.*

***Keywords:** CNC, Software, programming, G-code, design, technology, CAD, CAM, CAE.*

ТИПЫ НАПИСАНИЯ УПРАВЛЯЮЩИХ ПРОГРАММ ДЛЯ С ЧПУ

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***Аннотация:** В данной статье рассматриваются методы создания программы для обработки деталей для станков с числовым программным управлением используемых в машиностроении и производственных предприятий.*

***Ключевые слова:** ЧПУ, программа, программирование, G-код, проектирование, технология, CAD, CAM, CAE.*

Nowadays, all industries are reaching the peak of the development stage. Also, in the field of mechanical engineering, the digital system is moving. Digitally controlled (CNC) machines are now used in production instead of the previous simple machines. The production process is carried out on automatic lines.

CNC machines can be imagined as a system consisting of 3 blocks: the control program (a device for reading it); CNC devices and the machine itself.

Machining of details on RDB machines is carried out by creating a machining program. There are three software processing methods for RDB machines:

- Manual programming;
- Programming on the control panel of the CNC machine;
- Programming with CAD / CAM system.

1. Manual programming.

Manual programming is the creation of a control program by a programmer without the use of special software based on knowledge of commands.

So, this programming method is obviously the most time-consuming, it is used to create a simple detailing control program.

Manual programming consists of the following steps:

- preparation of technological information;
- calculation and analysis;
- coding;
- program recording;
- setup and preparation for production.

The most time-consuming phase is the phase of program creation and implementation, which accounts for 30% of the programming time. The first stage (preparation of technological data) is indispensable for any programming method. At the stage of technological preparation of the control program, the development of operational technology, the selection of tools, the selection of the sequence of working processes and technological transitions, the selection of cutting rhythms, etc. are carried out.

The computational and analytical stage consists of determining the coordinates of the trajectory points, for example, intersection points, straight lines with an arc, and so on. Technological points are necessary for changing cutting tools, as well as

changing processing modes (amount of push, frequency of rotation of the spindle, etc.)

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N100 G21
N102 G0 G17 G40 G49 G80 G90
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N104 T20 M6
N106 G0 G90 G54 X-35. Y-20. S0 M5
N108 G43 H20 Z10.
N110 G99 G73 Z-20. R10. Q2. F2.4
N112 M98 P1001
N114 G80
N116 M5
N118 G91 G28 Z0.
N120 G28 X0. Y0.
N122 M30

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N104 X20.
N106 Y20.
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N110 Y-20.
N112 X20.
N114 Y20.
N116 M99
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Figure 2. A program compiled for detail processing on the CNC machine

Processing in a CNC is usually programmed in a language known as ISO 7-bit language or G and M code language. The G and M code language is based on International Organization for Standardization (ISO) and Electronic Industry Association (ESA) rules.

Advantages

- Almost unlimited possibilities in program development.
- Allows you to change any process parameters (for example, cutting speed, cutting depth, thrust amount, etc.).
- Produces CNC programs more efficiently than most CAM systems.

Disadvantages

- G-code requires knowledge of programming language.
- A lot of time is spent on manual calculations and checks
- A large number of calculations increases the probability of programmer error
- A difficult process that requires the full involvement of the RDB developer
- Lack of programmers to implement programs at this level

2. Programming on the control panel of the CNC machine

This method consists of creating and entering programs directly on the CNC machine control panel using the keyboard and display. In this case, the necessary

parameters for detail processing are entered in the control panel. For example, the rotation frequency of the machine spindle, the amount of push, the position of the part, the coordinate of the cutting tool, etc.



Figure 3. Writing a control program using the CNC drilling machine and its control panel.

Advantages

- Easy to learn and simple to use.
- Does not require G-code to write a program.
- Reduced installation and programming times
- Fewer software errors.
- More economical than CAM system

Disadvantages

- Coordinate geometry is limited.
- Difficult to program for complex and shaped details.
- Does not support cutting tool magazine.
- Does not offer the flexibility of a CAM system.

3. Programming with CAD / CAM system.

Today, in order to succeed in the market, the industrial enterprise has to work on reducing the production time, reducing the cost and improving the quality. The rapid

development of computer and information technologies has led to the emergence of CAD / CAM / CAE systems, which are the most effective means of solving these problems.

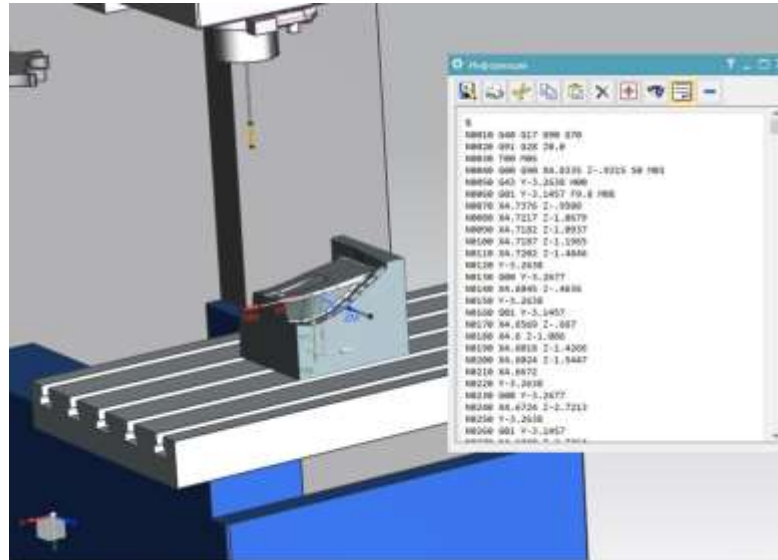


Figure 4. Writing a detail processing program using the CAM system of the Siemens NX program.

Advantages

- Does not require the programmer to perform mathematical calculations.
- Automates the programming process to increase overall productivity.
- It is easy to create a program for processing details with complex and shaped surfaces.

- Virtual simulation reduces machine downtime due to software errors.

Disadvantages

- Effective program management still requires basic knowledge of manual programming.
- Requires computer and CAD/CAM software (such as Siemens NX, Catia, Kompas 3D).
- The programmer-designer-technologist requires the skills of working with the above software.

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