

Study on CNC Machining Process and Technology

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Abstract: CNC machine is typically an electromechanical product mainly composed of a machine body and the computer numerical control system (CNC). The first benefits offer by any kind of CNC machine is improved automation.

Keywords: Computer numerical control, automation

1. Introduction

CNC machine is a typical electromechanical product mainly composed of machine body and the computer numerical control (CNC) system. It is the core equipment of modern manufacturing industry. [1] When we have to do mass production of similar job CNC machine is the most suitable option among conventional machines as on it will give more repeatability and accuracy. The first benefit offered by all forms of CNC machine tools is improved automation. The operator intervention related to producing work pieces can be reduced or eliminated. Many CNC machines can run unattended during their entire machining cycle, freeing the operator to do other tasks. This gives the CNC user several side benefits including reduced operator fatigue, fewer mistakes caused by human error, and consistent and predictable machining time for each work piece. Since the machine will be running under program control, the skill level required of the CNC operator (related to basic machining practice) is also reduced as compared to a machinist producing work pieces with conventional machine tools. The second major benefit of CNC technology is consistent and accurate work pieces. Today's CNC machines boast almost unbelievable accuracy and repeatability specifications. This means that once a program is verified, two, ten, or one thousand identical workpieces can be easily produced with precision and consistency. A third benefit offered by most forms of CNC machine tools is flexibility. Since these machines are run from programs, running a

different work piece is almost as easy as loading a different program. Once a program has been verified and executed for one production run, it can be easily recalled the next time the workpiece is to be run. This leads to yet another benefit, fast change-overs.

2. Working Principle

The working principle of a CNC machine is the execution of cutting tasks with the aid of a computer as well as written commands and codes. A highly skilled operator enters the information using a Human Machine Interface Device in the form of M or G codes. The memory of the information converts into binary codes that send electric pulses to the Servo drives. In response, these signals actuate the spindle and motors. For the spindle, the tool fits either horizontally or vertically. At that point, the machine then follows the instructions given, producing parts and components to tight tolerances.

CNC machines are advanced and are therefore capable of making repetitive cuts to specifications with incredible accuracy. For help with your standard or custom parts or components, we can help. At NexGen Machine, we have professionally trained operators, innovative CNC software, and cutting-edge machines. You can visit our website or contact us by phone. We would love the opportunity to have you as a valued customer.

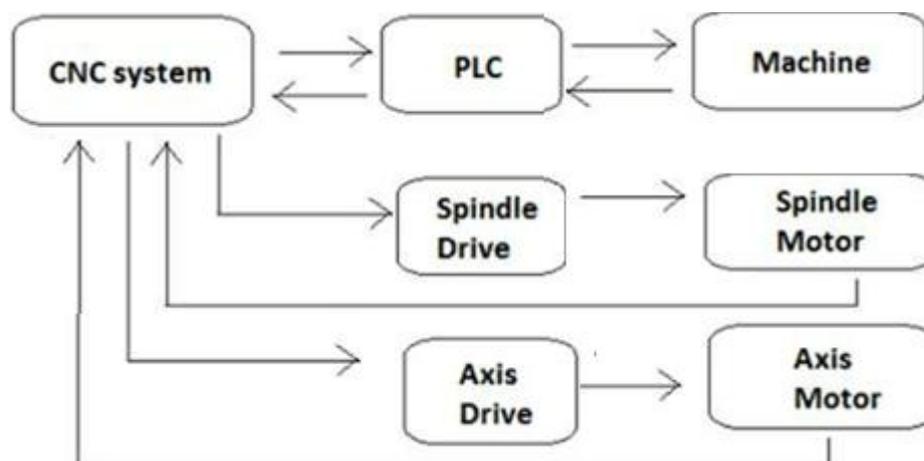


Figure: Working Principle of A CNC Machine

3. Types of CNC Machines

Following are the types of CNC Machines:

- CNC Milling Machine

- CNC Router
- CNC Plasma Cutting Machine
- CNC Lathe Machine
- CNC Laser Cutting Machine

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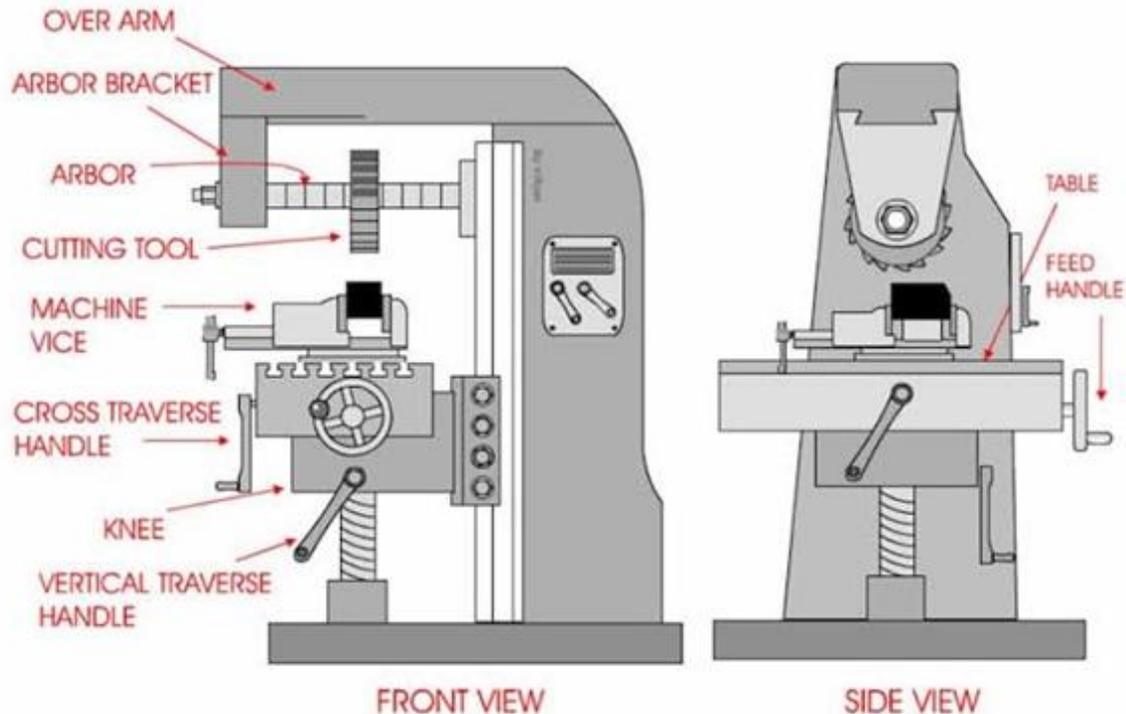
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- CNC Electrical Discharge Machine
- CNC Waterjet Cutting Machine
- CNC Grinder

1) CNC Milling Machine

One of the most common types of CNC machines, a CNC mill uses computer controls to cut various materials. Mills can translate specific programs from numbers and letters to

move the spindle in different ways. CNC milling machines are characterized by their ability to rotate cutting tools while holding the material workpiece / block stationary. You can machine a wide range of shapes, including face milled features and peripheral milled features. Components manufactured on CNC milling machines are typically square or rectangular with a variety of features.



2) CNC Router

A CNC router is a machine that is very similar to a CNC mill but is generally used for machining softer materials and is typically less precise compared to CNC mills. CNC routers are significantly cheaper than CNC mills. This type of CNC machine can help cut steel, wood, aluminum, composites, plastic, and foam.

CNC routers generally consist of a mechanical base, a spindle, stepper motors, stepper drivers, controllers, and a power supply. CNC routers reduce waste, increase productivity and accuracy, and produce products faster.

3) CNC Plasma Cutting Machine

CNC plasma cutting machines are similar to CNC milling machines in that they have the same function, which is cutting materials. However, CNC plasma cutting machines use a plasma torch to cut through their materials, while a milling machine uses an end mill or milling cutter attached to a spindle.

The main requirement for CNC plasma cutting machines is that when plasma cutting, the material or workpiece to be cut must be electrically conductive. CNC plasma cutting machines are also used to cut materials. However, they perform this process using a powerful plasma (electronically ionized gas) torch controlled by a computer.

4) CNC Lathe Machines

A lathe is a CNC machine designed to cut workpieces while they are rotated. CNC lathes can quickly make precise cuts with a variety of tools. These CNC machines are very effective in the precision they offer compared to manual lathes. They often have fewer axes than CNC milling machines and are therefore smaller and more compact.

CNC lathes have controls similar to CNC milling machines and can read G-code as well as other proprietary programming languages.

CNC lathes and turning machines are notable for their ability to rotate (turn) materials during the machining process.



5) CNC Laser Cutting Machine

These types of machines are similar to CNC plasma machines, the only difference being that lasers are primarily used for cutting and are great for cutting metals, plastic or hardwood. Depending on the density and strength of the material, the intensity of the laser can be adjusted.

CNC laser machines have a pointed router with a highly focused laser beam that is used to precisely cut, cut, or engrave materials. The laser heats the material and melts or vaporizes it, creating a cut in the material. Typically, the material is in sheet format and the laser beam moves back and forth across the material to create a precise cut.

4. Parts of CNC Machining:

A CNC machine is consists of the following parts:

- Bed
- Headstock
- Tailstock
- Footswitch or pedal
- Chuck
- Control panel
- Tool turret

Bed:

The bed is kind of hardened parts of a machine because The tool turret travels over the CNC lathe bed, kind of machining can't affect them.

Headstock:

The headstock is the main part of the machine, here the workpiece is fixed to perform an operation and also Headstock of a CNC lathe machine has the main motor which drives the main spindle.

Tailstock:

The tailstock is for providing extra grip to the workpiece. When the operations like knurling, threading has performed these parts used to hold the workpiece.

Footswitch or pedal:

Through these pedals, CNC machinist's open and close the chuck to grip the component, the same way tailstock quill is taken to forward position or reversed.

Chuck:

Chuck is mounted on the main spindle. Here we fixed the workpiece.

Control panel:

The control panel is another main part of the CNC machine in which we use to set or feed the program for the operation we perform on the workpiece.

This is also called the brain of a CNC machine.

5. Conclusion

CNC machine is having advantages as well as disadvantages at a time. If it is mass production, we should go for CNC machine only instead of conventional machine. As CNC machine is having high initial cost it is reliable for mass production only. For less production and small-scale industries conventional machine is more preferable if cost is limitation.

References

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