

实用数控技术丛书

数控技术英语

第 二 版

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化学工业出版社

· 北 京 ·

本书在第一版的基础上并结合近几年的教学实践对内容进行了较大的改进,主要是为了更加适合学生学习和数控教学的需要。从国外原版书籍中将常见数控技术内容提炼为 18 篇课文,包括数控技术简介、数控机床组成、零件加工工艺、编程技术(尤其重点介绍了各种编程方法和技巧)、程序调用、机床操作及安全等英语基本知识,并就高频词汇和句法做详细分析和讲解,课后的练习则帮助读者进一步巩固这些知识。

所配光盘中包括书中所有课文的 mp3 文件,以锻炼读者的听说能力。

本书特别适合做高职高专类数控专业英语教材,同时也适合于相关专业的工程技术人员自学。通过本书的学习,读者将可以在字典的帮助下,读懂一般的数控类英文文献。

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Unit 1 Introduction to Computer Numerical Control Manufacturing

Text

What are NC and CNC?

Numerical control has been used in industry for over 50 years. Simply put, numerical control is a method of automatically operating a manufacturing machine based on a code of letters, numbers, and special characters. ① A complete set of coded instructions for executing an operation is called a program. ② The program is translated into corresponding electrical signals for input to motors which run the machine.

A computer numerical control (CNC) machine is an NC machine with the added feature of an on-board computer. ③ The on-board computer is often referred to as the machine control unit or MCU. The components found in many CNC systems are shown in Figure 1-1.

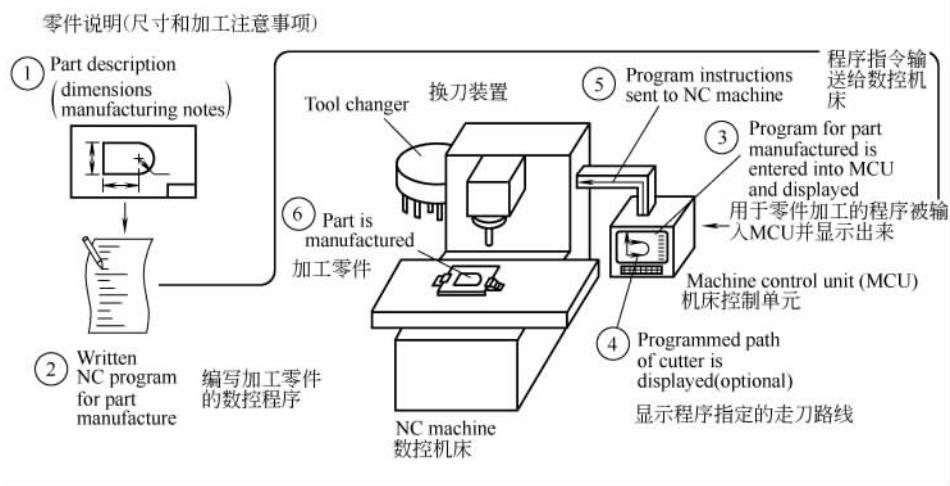


Figure 1-1 Components of modern CNC system
现代 CNC 系统的组成

Machine control unit: generates, stores and processes CNC programs.

NC machine: responds to programmed signals from the machine control unit and manufactures the part. ④

Types of CNC equipment

Machining centers are the latest development in CNC technology. These systems come equipped with automatic tool changers with the capability of changing up to 90 or more tools. ⑤ Many are also fitted with the movable rectangular worktables called pallets. The pallets are used to automatically load and unload work pieces. At a single setup machining centers can perform such operations as milling, drilling, tapping, boring, and so on. ⑥

Turning centers with increased capacity tool changers are also making strong appearance in modern production shops. ⑦ These CNC machines are capable of executing many different types of lathe cutting operations simultaneously on rotating part.

In addition to machining centers and turning centers, CNC technology has also been applied to many other types of manufacturing equipment. Among these are wire electrical discharge machines (wire EDM) and laser cutting machines.

New words

numerical [ˈnju(:)ˈmerikəl] adj. 数字的, 用数表示的

simply put 简单地讲

automatically [ɔ: təˈmætikli] adv. 自动地

operate [ˈɒpəreɪt] v. 操作, 运转

manufacture [ˌmænjuˈfæktʃə] vt. 制造, 加工 n. 制造, 制造业, 产品

base on v. 基于

corresponding [ˌkɒrɪsˈpɒndɪŋ] adj. 相应的, 一致的, 符合的, 通信的

motor [ˈməʊtə] n. 电动机

machine [məˈʃi:n] n. 机床

refer to 指, 谈到, 参照

on-board 在船(飞机, 车)上, 文中指内嵌在机床上

feature [ˈfi:tʃə] n. 特点

component [kəmˈpəʊnənt] n. 成分 adj. 组成的, 构成的

generate [ˈdʒenəreɪt] vt. 生成, 产生

process [ˈprəːses] vt. 加工, 处理 n. 过程

equipment [iˈkwɪpmənt] n. 装备, 设备

latest ['leɪtɪst] adj. 最近的

equip ['iːkwɪp] vt. 装备, 配备, 训练, 准备行装

capability [ˌkeɪpə'bɪləti] n. (实际) 能力, 性能, 容量, 接受力

machining centers 加工中心

fit [fɪt] v. 安装

pallet ['pælɪt] n. 托盘

rectangular [ˌrek'tæŋɡjʊlə] adj. 长方形的

load [ləʊd] v. 加载

unload [ˈʌn'ləʊd] vi. 卸载

work piece 工件

setup n. 作业准备, 装卡

milling ['mɪlɪŋ] n. 铣削

drilling ['drɪlɪŋ] n. 钻削

tapping ['tæpɪŋ] n. 攻丝

boring ['bɔːrɪŋ] n. 镗削

turning centers 车削中心

making appearance 公开露面

shop [ʃɒp] n. 商店, 工厂, 职业, 修理厂

simultaneously [sɪmə'lteɪniəsli] adv. 同时发生地, 同步地

execute ['eksɪkjʊ:t] vt. 执行

apply [ə'plaɪ] v. 申请, 应用

electrical discharge machine 电火花加工机床

wire electrical discharge machine 线切割机床

Notes

① Simply put, numerical control is a method of automatically operating a manufacturing machine based on a code of letters, numbers, and special characters.

简单地讲, 数字控制就是基于代码, 自动操作制造类机床的一种方法, 这些代码由字母、数字和特殊字符组成。

注意: machine 一词在本书中均翻译为机床, 而不是机器。

② A complete set of coded instructions for executing an operation is called a program.

所谓程序就是用于执行某一操作的一整套代码表示的指令。

注意: 大家都知道 code 是代码的意思, 可能会忽略它的动词含义——译为代码。这里是用它的过去分词形式修饰 instruction。

③ A computer numerical control (CNC) machine is an NC machine with the added feature of an on-board computer.

计算机数控机床就是在 NC 机床的基础上附加一个内嵌式计算机。

added feature 表示附加的特性。

④ NC machine: responds to programmed signals from the machine control unit and manufactures the part.

NC 机床：响应来自机床控制单元的程序信号并加工零件。

⑤ These systems come equipped with automatic tool changers with the capability of changing up to 90 or more tools.

这些系统装有自动换刀装置，可换刀具数高达 90 把甚至更多。

注意：up to 表示 高达……

⑥ At a single setup machining centers can perform such operations as milling, drilling, tapping, boring, and so on.

加工中心只需一次装卡就可以完成铣、钻、攻丝、镗等多种加工操作。

注意：setup 这个词在本书中频繁出现，可根据情况翻译成装卡或作业准备。

⑦ Turning centers with increased capacity tool changers are also making strong appearance in modern production shops.

具有大容量刀库的车削中心在现代制造厂中占据着显著位置。

Grammar study

通过一句话掌握现在完成时。

Numerical control has been used in industry for over 50 years.

数控在业界的应用已经超过 50 年。

这个句子属于现在完成时态，表示已经发生的事情，这件事情往往与现在的情况有联系。这包含两方面的含义，一方面它指的是现在，包含某个动作的一段时间从过去的某个时间开始一直到现在，所以这段时间仍属于现在。另一方面，这个动作在不同程度上被完成了，所持续的时间可以到说话时结束，也可以延续下去，这可以由句子中的时间状语来显现。

请看下面几个例子：

1. He has got a letter from his father.
2. She has rung me up four times this evening already.
3. I've seen little of my teacher in the past few years.

4. She has worked in the company since she graduated in 2000.
5. I have got a bad headache.
6. She has been here several times, but she's gone to live abroad.

Task 1. Fill in the blanks.

- (1) _____ you had your supper yet?
- (2) She _____ never broken her word.
- (3) She's _____ to do some shopping.
- (4) I have _____ terribly busy since I have been back.
- (5) Have you _____ to leave so soon?

Words study

……被称作（或叫做）……

In technical English, the following expressions are very common. Everybody has to master them.

called

A is known as B

referred to as

Task 2. Try to fill in the blanks with above phrases.

- (1) The point of intersection (**交点**) _____ (know) the origin.
- (2) When you are specifying coordinates from the program zero point (origin), it _____ (call) the absolute mode of programming.
- (3) A CNC machine is an NC machine with the added feature (**功能**) of an on-board (**内嵌的**) computer. The on-board computer _____ (refer) the machine control unit or MCU.
- (4) If a computer is used to create a program, the process _____ (know) computer-aided programming.
- (5) A complete set of coded instructions (**被编码的指令**) for executing (**执行**) an operation _____ (call) a program.

Task 3. Try to translate these sentences.

Note: The word 'find' here doesn't mean discover something (**发现, 找到什么东西**), instead, it used to say that something exists, grows, etc. somewhere (**存在或生长于什么地方**).

- (1) The components found in many CNC systems are shown in Figure 1-1.

- (2) This type of system is found on older NC drilling machines.
- (3) Systems of this type are usually found in vertical machining centers.
- (4) These flowers are found only in Africa.
- (5) You'll find this style of architecture all over the town.

Task 4. Everybody knows the word 'fit'. But can you translate the word in these sentences?

(1) Many are also fitted with the movable rectangular worktables called pallets.

(2) There are some machines *fitted* with specially designed AC motors that also provide for variable spindle speeds.

(3) The program is too long to *fit* into the control's memory.

fit 的词性和用法非常丰富，下面我们来学习常见的用法。

(1) fit 做及物动词，表示适合，胜任，安装，为……提供场所或时间，与……相配合等，请看下面例句。

This coat doesn't fit me.

这件大衣我穿不合身。

Some training will fit them for the job.

经过一些训练他们就会胜任工作。

Fit a handle on a door.

给门安上一个把手。

You can't fit any more toys in the box.

你在那箱子里已装不下更多的玩具了。

The doctor can fit you in today.

今天医生能跟你定个时间。

The observations fit the theory nicely.

观测与理论完全相符。

That sort of music fits your mood.

那种音乐适合你的心情。

The tailor fitted the trousers by shortening them.

裁缝把这条裤子裁短了一些使之合身。

(2) fit 做不及物动词表示适合，吻合，相配，和谐等意思，请看下面例句。

Try the new key and see if it fits.

试试新配的钥匙看看是否合适。

The shoes doesn't fit well.

这鞋不合脚。

She doesn't fit in with these people.

她与这些人格格不入。

His good mood fits in with the joyful occasion.

他良好的心绪与那欢快的场合很和谐。

(3) fit 也可以用作形容词。和系动词连用，表示“适合，恰当”等。和 feel 或 keep 等连用，表示精神极好，保持健康等。

He isn't fit for his work.

他不适合做这项工作。

The food isn't fit to eat.

这食物不好吃。

It's fit that he should say so.

他那样说是恰当的。

Though he is over 70 years old, he feels fit.

尽管他 70 多岁，但精神头极好。

I hope you are keeping fit.

我希望你能保持健康。

(4) fit 也可以做名词，表示合身，合身的衣服。

Fit is even more important than color.

合身比颜色更重要。

The coat is a good fit.

这件大衣很合身。

Occupation link

General Safety Rules for Operating Any CNC Machine

- Prior to machine operations:

Read the safety instructions label posted on the CNC machine.

Confirm safety of personnel (人员) near the CNC machine.

Remove all obstacles (障碍物) from the machine's working area.

Make sure protection fence is closed.

- During machining operations:

Do not enter the working area.

Make sure oil or water does not splash (飞溅) power supply units.

Wear protective goggles (护目镜) and clothing. Put long hair up.

- Use the EMERGENCY STOP control when there is a possibility of personal injury (受伤) or any machine/part damage (受损).

- During troubleshooting (故障检测) and maintenance:

Allow only qualified personnel to work on the machine.

First turn off the power supply.

Be aware that power is still present in the primary side power cables to the breaker (断路器) box.

Technical reading

Task 5. Read the text and try to describe the components of NC system.

What is NC?

Traditionally, numerical control systems have been composed of the following components:

Tape punch: converts written instructions into a corresponding hole pattern. The hole pattern is punched into tape which passes through this device. Much older units used a typewriter device called a Flexowriter. Newer devices include a microcomputer coupled with a tape punch unit.

Tape reader: reads the hole pattern on the tape and converts the pattern to a corresponding electrical signal code.

Controller: receives the electrical signal code from the tape reader and subsequently causes the NC machine to respond.

NC machine: responds to programmed signals from the controller. Accordingly, the machine executes the required motions to manufacture a part (spindle rotation on/off, table and or spindle movement along programmed axis directions, etc.).

See Figure 1-2.

approach [ə'prəʊtʃ] n. 方法

convert [kən'veɪt] n. vt. 转换, 改变

punch [pʌntʃ] vt. 打洞, 打孔, 猛击

flexowriter ['fleksə,raɪtə] n. 电传打字机

couple ['kʌpl] vt. 连合, 连接, 结合 vi. 结合, 结婚 n. (一) 对, (一) 双, 夫妇

subsequently ['sʌbsɪkwəntli] adv. 以后, 后来

accordingly [ə'kɔ: dɪŋli] adv. 因此, 于是, 相应地, 如前所说, 适当地

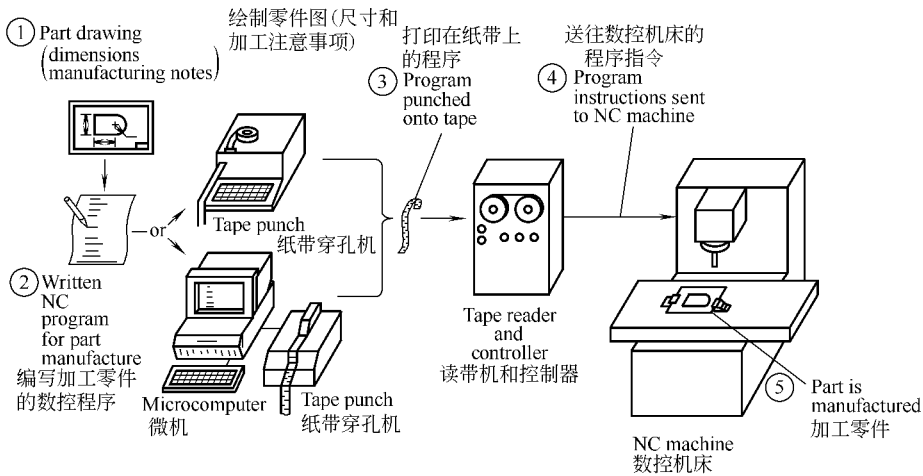


Figure 1-2 Components of traditional NC systems

传统 NC 系统的组成

Translation

单元 1 计算机数控加工简介

什么是NC 和CNC ？

数控在业界的应用已经超过 50 年。简单地说，数字控制就是基于代码，自动操作制造类机床的一种方法，这些代码由字母、数字和特殊字符组成。所谓的程序就是用于执行某一操作的一整套代码表示的指令。程序被转换成相应的电子信号输入到电机中从而驱动机床运转。

计算机数控机床就是在 NC 机床基础上附加一个内嵌式计算机。这种内嵌式计算机通常被称为机床控制单元或 MCU。CNC 系统的组成，如图 1-1 所示。

机床控制单元：生成、存储和处理 CNC 程序。

NC 机床：响应来自机床控制单元的程序信号并加工零件。

CNC 设备的类型

加工中心在 CNC 技术中属于最前沿的发展。这些系统装有自动换刀装置，可换刀具数高达 90 把甚至更多。它们中许多都配有矩形工作台，即托盘系统。这种托盘系统用来自动装卸工件。加工中心只需一次装卡就可以完成铣、钻、攻丝、镗等多种加工操作。

具有大容量刀库的车削中心在现代制造厂中占据着显著位置。这些 CNC 机床能对旋转的工件同时进行多种车削加工。

除加工中心和车削中心之外，CNC 技术还被广泛用于其他许多类型的设备，其中包括线切割机床和激光切割机。

Unit 2 CNC Machining Centers

Text

CNC machining centers were described briefly in Unit 1. By definition, a machining center is a CNC machine that incorporates some form of automatic tool changer and is capable of performing multiple machining operations.^① In the development of machining centers, the horizontal machining center came from the milling machine and the vertical machining center from the drilling machine.

A vertical machining center has the spindle oriented in the vertical position.^② To favor drilling, vertical machining centers tend to be lower in horsepower, relatively small in diameter, and higher in speed.^③ An automatic tool changer is mounted to the machine (usually on the left side) to allow tools to be loaded into the spindle without operator intervention. Basic vertical machining centers will allow three directions of motion, or axes. The table can move left to right (the X axis). The table can move in and out, toward and away from the operator (the Y axis). And the headstock or spindle can move up and down (the Z axis). Long flat parts are much easier to fixture on a vertical and spindle thrusts are absorbed by the table.^④ An important factor favoring verticals is that they are less expensive than horizontals. See Figure 2-1.



Figure 2-1 A vertical machining center
立式加工中心

Horizontal machining centers are heavier and slower to favor milling. There are about two verticals for every horizontal in the industry.^⑤ A horizontal machining center has the spindle oriented in the horizontal position. Again, an automatic tool changer is equipped to allow tools to be automatically placed in the spin-

dle. The table motion left to right (as viewed from the spindle) is still the X axis. But now the head motion up and down is considered the Y axis. And the table motion toward and away from the spindle is the Z axis. See Figure 2-2.



Figure 2-2 A horizontal spindle machining center
卧式加工中心

New words

- describe [dis'kraib] vt. 描写, 记述
briefly ['brɪflɪ] adv. 暂时地, 简要地
definition [ˌdefɪ'nɪʃən] n. 定义
incorporate [ɪn'kɔ:pəreɪt] vt. 合并
perform [pə'fɔ:m] vt. 执行
multiple ['mʌltɪpl] adj. 多样的, 多重的
milling machine 铣床
drilling machine 钻床
spindle ['spɪndl] n. 轴
orient ['ɔ:riənt] vt. 确定方向
favor ['feɪvə] vt. 像, 似
horsepower ['hɔ:s,pauə] n. 马力
tend to 趋向, 往往是
mount [maʊnt] vt. 安装
operator ['ɔ:pəreɪtə] n. 操作员
intervention [ˌɪntə(ɪ)'venʃən] n. 干预, 干涉
axis ['æksɪs] n. 轴 pl. axes ['æksɪz]
headstock ['hedstɒk] n. 主轴箱
fixture ['fɪkstʃə] v. 固定
thrust [θrʌst] n. 推力, 冲击
absorb [əb'sɔ:b] vt. 吸收, 吸引

Notes

- ① By definition, a machining center is a CNC machine that incorporates

some form of automatic tool changing and is capable of performing multiple machining operations.

从定义上讲，加工中心就是装有某种形式的自动换刀系统的 CNC 机床，它可以执行多种加工操作。

② A vertical machining center has the spindle oriented in the vertical position.

立式加工中心的主轴走向是竖直的。

③ To favor drilling, vertical machining centers tend to be lower in horsepower, relatively small in diameter, and higher in speed.

和钻床相似，立式加工中心往往具有小马力、小直径和高转速的特点。

注意：表达在某方面有何特点时，常用结构 be + adj. + in...，比如该句中：be lower in horsepower, small in diameter, higher in speed.

④ Long flat parts are much easier to fixture on a vertical and spindle thrusts are absorbed by the table.

长而平的工件易于安装在立式加工中心上，而且主轴产生的冲击力易于被工件吸收。

⑤ There are about two verticals for every horizontal in the industry.

立式加工中心与卧式加工中心在工业中的比例约为 2 : 1。

Grammar study

通过一句话掌握被动语态。

CNC machining centers were described briefly in Unit 1.

在第一单元中已经简要介绍了 CNC 加工中心。

由于英汉两种语言表达习惯不同，英语使用被动语态的频率要比汉语多得多。因此有必要搞清楚在什么情况下使用被动语态。

(1) 在不知道执行者是谁的情况下，如：

A glass was broken yesterday.

(2) 在动作执行者是泛指或不言自明的情况下。本课第一句就属于这种情况，又如：

He was born in 1919.

Good use is made of the library. 该图书馆利用率很高。

(3) 虽然可以说出执行者，但动作的承受者是谈话的中心或特别需要强调的情况下，如：

The stairs should be repaired.

At last an agreement was arrived at.

(4) **为了婉转、礼貌而避免提及自己或对方时，如：**

Enough has been said here of the question.

You are wished to come early.

Task 1. Study these instructions for a simple experiment on friction (摩擦),

Then complete the description of the experiment using the present passive (被动语态).

(1) Place a block (木块) of wood on a flat surface.

(2) Attach a spring balance (弹簧秤) to one end of the block.

(3) Apply (施加) a gradually increasing force to the balance.

(4) Note the force at which the block just begins to move.

(5) Pull the block along so that it moves at a steady speed (匀速).

(6) Note the force required to maintain (保持) movement.

(7) Compare (比较) the two forces.

When we describe this experiment, we write:

A block of wood is placed on a flat surface. A spring balance is attached to one end of the block.

This description use the present passive. We form the present passive (现在的被动语态) using is/are + past participle (过去分词).

Now fill in the blanks.

A block of wood _____ on a flat surface, A spring balance _____ to one end of the block. A gradually increasing force _____ to the balance. The force at which the block just begins to move _____.

The block _____ along at a steady speed. The force required to maintain movement _____. The two forces _____. It is found that the first force is greater than the second.

What does this experiment show?

Words study

Task 2. Learn the word 'favor' and then do the translation.

这个词的含义很多，用法灵活，这里我们把最常见的用法总结出来。

(1) 做名词，表示帮忙，好感，偏爱，赞成，好处等，请看例句：

Would you do me a favor?

你能帮我一个忙吗?

That might be in your favor.

那可能对你有利。

The case went in his favor.

他官司打赢了 (这案件判决他胜诉)。

Are you in favor of his opinion?

你会赞成他的意见吗?

He has a prejudice in our favor.

他对我们有偏爱。

The judge administers to the law, without fear or favor.

法官坚决维护法律, 既不畏惧也不偏袒。

They were in favor of the Democratic candidate for President.

他们支持民主党总统候选人。

The distributor looks with favor on your sample shipment.

您发来的样货得到了经销商们的赞许。

They will look with favor on your proposal.

他们将会赞同你的建议。

He did all he could to win his favor.

他尽其所能去赢得他的好感。

(2) 做动词表示赞成, 关照, 偏爱, 相似等, 请看例句:

I favor his ideas over all the others.

我偏爱他的想法。

Some elevated people favor the new policy.

一些高层人士支持该项新政策。

A mother mustn't favor one of her children more than the others.

母亲不应对任何一个儿女有所偏爱。

To favor drilling, vertical machining centers tend to be lower in horsepower.

和钻床相似, 立式加工中心往往具有小马力。

Now do the translation.

- a. I came to ask you a favor.
- b. The court ruled in her favor.
- c. In their discussion, I was in favor of Mr. Li.
- d. She is all in favor of my suggestion.