教育部高职高专规划教材

技能型紧缺人才培养培训系列教材

数控技术应用专业英语

常红梅 主编
曾小珊 主审

化学工业出版社
教材出版中心

教育部高职高专规划教材

技能型紧缺人才培养培训系列教材

数控技术应用专业英语

常红梅　主编
曾小珊　主审

化学工业出版社
教材出版中心
·北京·

图书在版编目(CIP)数据

数控技术应用专业英语/常红梅主编．—北京：化学工业出版社，2005.12
教育部高职高专规划教材
技能型紧缺人才培养培训系列教材
ISBN 7-5025-7975-3

Ⅰ．数… Ⅱ．常… Ⅲ．数控机床-英语-高等学校：技术学院-教材 Ⅳ．H31

中国版本图书馆 CIP 数据核字（2005）第 145965 号

教育部高职高专规划教材
技能型紧缺人才培养培训系列教材
数控技术应用专业英语
常红梅 主编
曾小珊 主审
责任编辑：高 钰
文字编辑：宋 薇
责任校对：郑 捷
封面设计：于 兵

*

化学工业出版社
教材出版中心 出版发行
（北京市朝阳区惠新里 3 号 邮政编码 100029）
购书咨询：(010)64982530
(010)64918013
购书传真：(010)64982630
http://www.cip.com.cn

*

新华书店北京发行所经销
北京市彩桥印刷厂印装
开本 787mm×1092mm 1/16 印张 10½ 字数 251 千字
2006 年 1 月第 1 版 2006 年 1 月北京第 1 次印刷
ISBN 7-5025-7975-3
定 价：18.00 元

版权所有 违者必究
该书如有缺页、倒页、脱页者，本社发行部负责退换

数控技术专业系列教材编委会

主　任

覃　岭

副主任

冯建雨　唐义锋　苑章义

编　委

（按姓氏汉语拼音排序）

常红梅　陈粟宋　程时甘　洪　凯
黄劲枝　孔　杰　龙光涛　麻　艳
毛卫秀　孙贵杰　吴新腾　徐建高
杨永平　尹玉珍　赵俊生　钟江鸿

出 版 说 明

高职高专教材建设工作是整个高职高专教学工作中的重要组成部分。改革开放以来，在各级教育行政部门、有关学校和出版社的共同努力下，各地先后出版了一些高职高专教育教材。但从整体上看，具有高职高专教育特色的教材极其匮乏，不少院校尚在借用本科或中专教材，教材建设落后于高职高专教育的发展需要。为此，1999 年教育部组织制定了《高职高专教育专门课课程基本要求》（以下简称《基本要求》）和《高职高专教育专业人才培养目标及规格》（以下简称《培养规格》），通过推荐、招标及遴选，组织了一批学术水平高、教学经验丰富、实践能力强的教师，成立了“教育部高职高专规划教材”编写队伍，并在有关出版社的积极配合下，推出一批“教育部高职高专规划教材”。

“教育部高职高专规划教材”计划出版 500 种，用 5 年左右时间完成。这 500 种教材中，专门课（专业基础课、专业理论与专业能力课）教材将占很高的比例。专门课教材建设在很大程度上影响着高职高专教学质量。专门课教材是按照《培养规格》的要求，在对有关专业的人才培养模式和教学内容体系改革进行充分调查研究和论证的基础上，充分汲取高职、高专和成人高等学校在探索培养技术应用型专门人才方面取得的成功经验和教学成果编写而成的。这套教材充分体现了高等职业教育的应用特色和能力本位，调整了新世纪人才必须具备的文化基础和技术基础，突出了人才的创新素质和创新能力的培养。在有关课程开发委员会组织下，专门课教材建设得到了举办高职高专教育的广大院校的积极支持。我们计划先用 2～3 年的时间，在继承原有高职高专和成人高等学校教材建设成果的基础上，充分汲取近几年来各类学校在探索培养技术应用型专门人才方面取得的成功经验，解决新形势下高职高专教育教材的有无问题；然后再用 2～3 年的时间，在《新世纪高职高专教育人才培养模式和教学内容体系改革与建设项目计划》立项研究的基础上，通过研究、改革和建设，推出一大批教育部高职高专规划教材，从而形成优化配套的高职高专教育教材体系。

本套教材适用于各级各类举办高职高专教育的院校使用。希望各用书学校积极选用这批经过系统论证、严格审查、正式出版的规划教材，并组织本校教师以对事业的责任感对教材教学开展研究工作，不断推动规划教材建设工作的发展与提高。

教育部高等教育司

2001 年 4 月 3 日

此为试读，需要完整PDF请访问：www.ertongbook.com

前　言

今天，从乡镇的小企业到全球的500强企业，数控技术无处不在，而且应用范围已经超出了机械制造行业。这些创新性的技术触及到制造业的方方面面，因此，从事制造业的人都必须清楚这些复杂机床的功能。在快速发展的数控技术专业领域，大量的原版英文技术资料和互联网提供的最新技术信息与动态，使得英语水平对于专业技术的学习和提高有着举足轻重的作用。

编者根据高等职业教育数控技术应用专业领域技能型紧缺人才的培养目标，结合专业英语的教学实践编写了本教材。学生在具备一定数控专业知识的基础上，通过大量阅读和本专业有关但文字内容相对浅显的英文文章，获得专业英语阅读理解能力和英汉转换能力，加深对数控专业知识的了解。

本书共8个单元，介绍了数控技术的基础知识、数控技术在各个方面的应用、数控车床及车削加工的基本知识、数控车床的编程技术、数控编程、数控机床操作以及机电一体化方面的知识。除此之外，书后还附有科技英语中的语法和翻译，以及一些与数控技术专业相关的阅读材料。材料选自国内外的专业书刊和大专院校教科书的部分章节，语言简明流畅，实用性较强。不仅可以使读者学习专业英语，而且可熟悉有关数控专业的词汇。在编写本书的过程中，考虑到高职学生的英语水平，我们尽可能使每篇文章的长短适量、难易适中，每篇课文后均有注释和词汇表。课文中出现的难句和语法难点，均在课后的注释中加以解释，并译为中文。为便于查阅和学习，书后还附有参考译文。

另外，我们还向读者提供一些建议，也许会有所帮助。一般来说，即使掌握了一定程度的英语，在阅读专业英语时，也会有一定的困难。所以，在阅读本书时，可先找出生词，标出词义。然后分析句子的结构，弄清全句的意思。为了便于读者学习，书后附有参考译文，仅供参考。

本书由常红梅主编、孙志学任副主编。本书由曾小珊教授主审。各单元编写的具体分工如下：第一部分的Unit 2、Unit 4、Unit 6、Unit 8、第二部分的相应参考译文、第三部分、第四部分、第六部分由常红梅编写，Unit 1、Unit 5、Unit 7及其第二部分的相应参考译文由孙志学编写，Unit 3及其第二部分的相应参考译文由王李云编写，第五部分由常红梅、孙志学共同编写，全书由常红梅负责统稿。

在编写过程中，因水平有限，不妥之处在所难免，敬请读者批评指正。

编　者

2005年8月

目　录

SECTION ONE　TEXTS

第一部分　课文 …… 1

UNIT 1　COMPUTER NUMERICAL CONTROL OF MACHINE TOOLS …… 1

Lesson 1　Introduction …… 1

Lesson 2　The Types of NC Machine …… 2

Lesson 3　The Advantages and Disadvantages of CNC Machines …… 4

Lesson 4　The Construction of CNC Machines …… 5

UNIT 2　NUMERICAL CONTROL TECHNOLOGY APPLYCATIONS …… 8

UNIT 3　INTRODUCTION TO THE CNC LATHE …… 13

Lesson 1　Components of Modern CNC Lathes …… 13

Lesson 2　CNC Lathe Axes of Motion …… 15

Lesson 3　Tools for CNC Lathe Operations …… 16

Lesson 4　Basic Lathe Operations …… 19

Lesson 5　Cutting Speeds and Feeds for Lathe Operations …… 22

Lesson 6　Some Definitions for Lathe Operations …… 23

UNIT 4　TECHNIQUES FOR CNC LATHE PROGRAMMING …… 25

Lesson 1　Tool Edge Programming …… 25

Lesson 2　Setting up Tool Nose Radius Compensation …… 26

Lesson 3　Some Restrictions with Tool Nose Radius Compensation …… 27

Lesson 4　Tool Nose Radius Compensation Commands …… 27

UNIT 5　NC PROGRAMMING …… 28

Lesson 1　Coordinate System for NC Machines …… 28

Lesson 2　The Control Functions of NC Machine …… 30

Lesson 3　NC Part Programming …… 33

Lesson 4　Training Programmers …… 35

UNIT 6　MODERN COMPUTER-AIDED PART PROGRAMMING …… 37

Lesson 1　Modern Development in the Process of CNC Programming …… 37

Lesson 2　An Introduction to Computer-aided Programming Languages …… 38

Lesson 3　Introductions to CAD/CAM Technology …… 39

Lesson 4　Elements of Comprising CAD …… 40

Lesson 5　The Elements Comprising CAM …… 42

Lesson 6　Knowledge-based Machining (KBM) …… 44

UNIT 7　NC MACHINE OPERATION …… 45

Lesson 1　The Operation Panel …… 45

Lesson 2　Safety Notes for CNC Machine Operations …… 50

Lesson 3 Daily Maintenances …… 52
Lesson 4 Fault Diagnosis and Action …… 52
UNIT 8 MECHATRONICS …… 54
Lesson 1 Introduction of Mechatronics …… 54
Lesson 2 Benefits of Mechatronics …… 57
SECTION TWO TRANSLATIONS
第二部分 参考译文 …… 64
第一单元 数字控制与计算机数字控制 …… 64
第一课 概述 …… 64
第二课 数控机床的类型 …… 64
第三课 计算机数控机床的优缺点 …… 65
第四课 计算机数控机床的结构 …… 65
第二单元 数控技术应用 …… 66
第三单元 数控车床 …… 68
第一课 现代数控车床的组成 …… 68
第二课 数控车床的运动轴 …… 69
第三课 数控车床加工用刀具 …… 70
第四课 车床的基本操作 …… 71
第五课 车削加工的切削速度和进给量 …… 72
第六课 车削加工中的一些定义 …… 72
第四单元 数控车床编程技术 …… 73
第一课 刀缘编程法 …… 73
第二课 建立刀尖半径补偿 …… 73
第三课 关于刀尖半径补偿的一些规定 …… 74
第四课 刀尖半径补偿指令 …… 74
第五单元 数控编程 …… 74
第一课 数控机床坐标系 …… 74
第二课 数控机床的控制功能 …… 75
第三课 数控零件编程 …… 76
第四课 编程人员的培训 …… 78
第六单元 现代计算机辅助零件编程 …… 79
第一课 现代 CNC 编程过程中的发展 …… 79
第二课 计算机辅助编程语言简介 …… 79
第三课 CAD/CAM 技术简介 …… 79
第四课 CAD 的组成元素 …… 80
第五课 CAM 的组成元素 …… 81
第六课 (KBM) 基于知识的加工 …… 81
第七单元 数控机床操作 …… 82
第一课 操作面板 …… 82
第二课 计算机数控机床安全操作注意事项 …… 84

第三课　数控机床的日常维护 …… 85
第四课　故障诊断和维修 …… 85
第八单元　机电一体化 …… 87
第一课　机电一体化介绍 …… 87
第二课　机电一体化的优点 …… 88
SECTION THREE　VOCABULARY …… 90
第三部分　词汇 …… 90
SECTION FOUR　GRAMMAR …… 98
第四部分　语法 …… 98
SECTION FIVE　READING MATERIAL …… 113
第五部分　阅读材料 …… 113
SECTION SIX　APPENDIX …… 150
第六部分　附录 …… 150
参考文献 …… 157

SECTION ONE TEXTS
第一部分 课 文

UNIT 1 COMPUTER NUMERICAL CONTROL OF MACHINE TOOLS

Lesson 1 Introduction

One of the most fundamental concepts in the area of advanced manufacturing technologies is numerical control (NC). The NC concept was proposed in the late 1940s by John Parsons of Traverse City, Michigan. Numerical Control (NC) is any machining process in which the operations are executed automatically in sequences as specified by the program that contains the information for the tool movements. ① In its earliest stages, NC machines were able to make straight cuts efficiently and effectively.

In 1949, the U. S. Air Force awarded Parsons a contract to develop a new type of machine tool that would be able to speed up production methods. Parsons commissioned the Massachusetts Institute of Technology (M. I. T.) to develop a practical implementation of his concept. Scientists and engineers at M. I. T. built a control system for a two-axis milling machine that used a perforated paper tape as the input media. In a short period of time, all major machine tool manufacturers were producing some machines with NC, but it was not until the late 1970s that computer-based NC became widely used. NC matured as an automation technology when inexpensive and powerful microprocessors replaced hard-wire logic-making computer-based NC systems.

When Numerical Control is performed under computer supervision, it is called Computer Numerical Control (CNC) (Fig. 1-1). Computers are the control units of CNC machines; they are built in or linked to the machines via communications channels. When a programmer inputs some information in the program by tape disk and so on, the computer calculates all necessary data to get the job done.

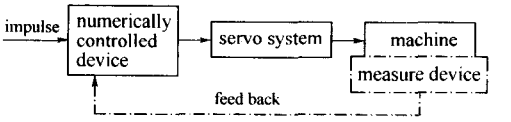

Fig. 1-1 Components of CNC

When the first Numerically Controlled (NC) machine was controlled by punched tape, and because of that, the NC systems were known as tape-controlled machines. ② They were able to control a single operation entered into the machine by punched or magnetic tape. There was no possibility of editing the program on the machine. To change the program, a new tape had to be made.

Today's systems have computers to control data, they are called Computer Numerically

Controlled (CNC) machines. For both NC and CNC systems, the work principles are the same. Only the way in which the execution is controlled is different.③ Normally, new systems are faster, more powerful, and more versatile.

New Words and Phrases

numerical control (NC) 数字控制
computer numerical control (CNC) 计算机数字控制
advanced manufacturing technologies 先进制造技术
Massachusetts Institute of Technology (M. I. T.) 麻省理工学院
servo system 伺服系统
measure device 测量装置
impulse *n.* 脉冲
milling cutter 铣刀
implementation *n.* 工具，仪器，执行过程
hard-wire *n.* 硬线连接
two-axis *n.* 两坐标
versatile *adj.* 多方面的，多变的，多用途的

Notes

① Numerical Control (NC) is any machining process in which the operations are executed automatically in sequences as specified by the program that contains the information for the tool movements.
数字控制是按照含有机床（刀具）运动信息程序所指定的顺序自动执行操作的加工过程。
此句中包含两个定语从句，第一个从句的先行词是 machining process，in which 引导从句 the operations are executed automatically in sequences as specified by the program that contains the information for the tool movements. 在定语从句中 that contains the information for the tool movements 作定语从句，修饰 the program。

② When the first Numerically Controlled (NC) machine was controlled by punched tape, and because of that, the NC systems were known as tape-controlled machines.
第一台数控机床的数据是由穿孔纸带控制的，因此数控系统被称为纸带控制机床。

③ Only the way in which the execution is controlled is different.
只是控制执行的方式不同。
此句的主干结构是“the way is different”，“in which the execution is controlled”作为定语从句修饰 the way。

Lesson 2 The Types of NC Machine

Since its introduction, NC technology has found many applications, including lathes and turning centers, milling machines and machining centers, punches, electrical discharge machines (EDM), flame cutters, grinders, and testing and inspection equipment.① The most complex CNC machine tool is the turning center (Fig. 1-2). And the machining center (MC) (Fig. 1-3) (Vertical machining center, with the tool magazine on the left and the control panel on the right, which can be swiveled by the operator) and (Fig. 1-4) (Horizontal machining center, equipped with an automatic tool changer). The EDM and flame cutter are special type of NC machines (Fig. 1-5 and Fig. 1-6).

此为试读，需要完整PDF请访问：www.ertongbook.com

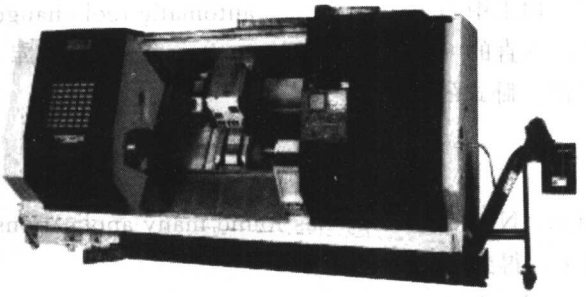

Fig. 1-2　A modern turning center

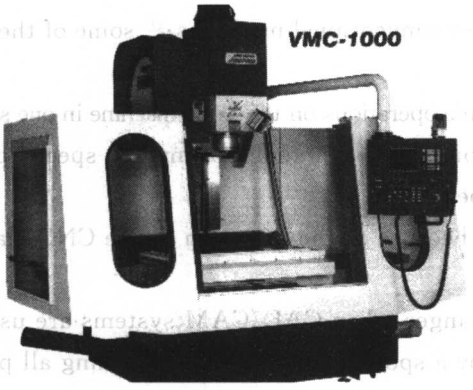

Fig. 1-3　A vertical-spindle machining center

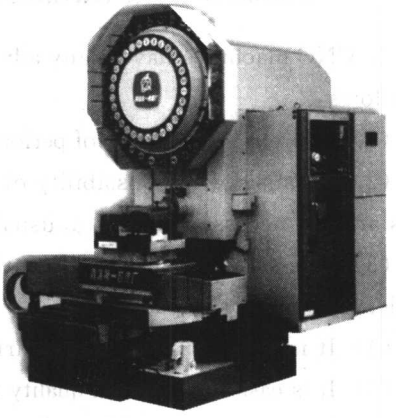

Fig. 1-4　A horizontal-spindle machining center

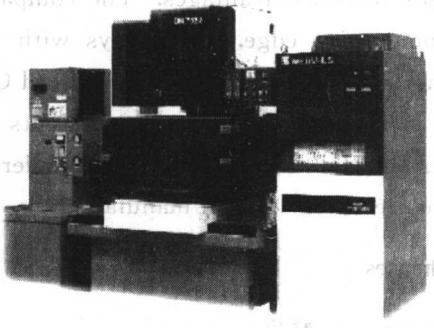

Fig. 1-5　A EDM

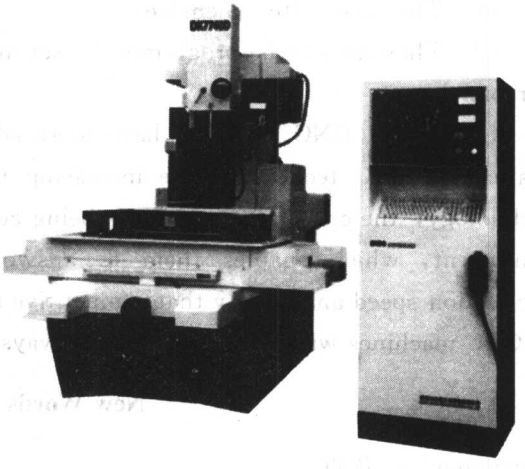

Fig. 1-6　A flame cutter machine

New Words and Phrases

lathe　*n.* 车床
turning center　*n.* 车削加工中心
milling machine　*n.* 铣床
machining center　*n.* 铣削加工中心
electrical discharge machine（EDM）　*n.* 电火花加工机床
flame cutter　*n.* 线切割机床
grinder　*n.* 磨床

machine center (MC) 加工中心
vertical *adj.* 立式的，垂直的
horizontal *adj.* 水平的，卧式的
automatic tool changer 自动刀具交换机构
tool magazine 刀库

Notes

① Since its introduction, NC technology has found many applications...
数控技术自发明以来，得到了广泛的应用……
此句中 its 指代 NC technology

Lesson 3 The Advantages and Disadvantages of CNC Machines

1. CNC machines have many advantages over conventional machines;① some of them are as follows:

(1) There is a possibility of performing multiple operations on the same machine in one set-up;

(2) Because of the possibility of simultaneous multi-axis tool movement, special profile tools are not necessary to cut unusual part shapes;

(3) The scrap rate is significantly reduced because of the precision of the CNC machine and lesser operator impact;②

(4) It is easy to incorporate part design changes when CAD/CAM systems are used;④

(5) It is easier to perform quality assurance by a spot-check instead of checking all parts;

(6) Production is significantly increased.

2. CNC machines also have some disadvantages:

(1) They are quite expensive;

(2) They have to be programmed, set up, operated, and maintained by highly skilled personnel.

Obviously, CNC machines have more advantages than disadvantages. The companies that adopt CNC technology are increasing their competitive edge. As always with new technology, the cost per CNC unit is being cut further and more companies can afford CNC equipment, which enables them to answer the increasingly strong requirements for production speed and quality that competitive markets demand. In the future the broader use of CNC machines will be one of the best ways to enhance automation in manufacturing.

New Words and Phrases

advantage *n.* 优点
disadvantage *n.* 缺点
perform *v.* 执行
multiple *adj.* 多个
simultaneous *adj.* 联动
conventional *adj.* 传统的
set up 安装
special profile tools 成形刀具
precision *n.* 精度
scrap *n.* 废品
CAD (computer aided design) 计算机辅助设计
CAM (computer aided manufacturing) 计算机辅助制造
maintain *v.* 维护，护养

Notes

① NC machines have many advantages over conventional machines;
计算机数控机床和传统机床相比具有很多优点;
over，介词，超过，越过

② The scrap rate is significantly reduced because of the precision of the CNC machine and lesser operator impact;
由于计算机数控机床的精度高，受操作者影响小，废品率明显降低。
because of 因为，由于……的原因

③ It is easy to incorporate part design changes when CAD/CAM systems are used;
采用 CAD/CAM 系统后，对零部件装配设计的修改就变得很容易。
此句中 it 作形式主语，真正的主语是 "to incorporate part design changes"。

Lesson 4　The Construction of CNC Machines

CNC machine tools are complex assemblies. However, in general, any CNC machine tool consists of the following units:

- **Computers**
- **Control systems**
- **Drive motors**
- **Tool magazine and changers**

1. Computers

The computer reacts on. As with all computers, the CNC machine computer works on a binary principle using only two characters 1 and 0, for information processing precise time impulses from the circuit. There are two states, a state with voltage, 1, and a state with voltage, 0. Series of ones and zeroes are the only states in which the computer distinguishes a so-called machine language; it is the only language the computer understands. When creating the program, the programmer need not care about the machine language. He or she simply uses a list of codes and keys in the meaningful information. Special built-in software compiles the program into machine language and the machine moves the tool by its servomotors. However, the programmability of the machine is dependent on whether there is a computer in the machine's control. ① If there is a minicomputer programming, say, a radius (which is a rather simple task), the computer will calculate all the points on the tool path. On the machine without a minicomputer, this may prove to be a tedious task, since the programmer must calculate all the points of intersection on the tool path. Modern CNC machines use 32-bit processors in their computers that allow fast and accurate processing of information.

2. Control Systems

There are two types of control systems on NC/CNC machines: open loop (Fig. 1-7) and closed loop (Fig. 1-8). The type of control loop used determines the overall accuracy of the machine.

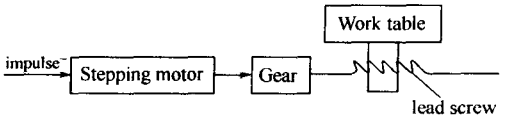

Fig. 1-7 Typical open loop control systems

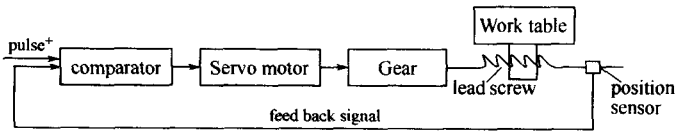

Fig. 1-8 Typical close loop control systems

The open-loop control system does not provide positioning feedback to the control unit. The movement pulses are sent out by the control unit and they are received by a special type of servomotor called a stepper motor. The number of pulses that the control unit sends to the stepper motor controls the amount of the rotation of the motor. ② The stepper motor then proceeds with the next movement command. Since this control system only counts pulses and cannot identify discrepancies in positioning, the machine will continue this inaccuracy until somebody finds the error.

The open-loop control can be used in applications in which there is no change in load conditions, such as the NC drilling machine. The advantage of the open-loop control system is that it is less expensive, since it does not require the additional hardware and electronics needed for positioning feedback. The disadvantage is the difficulty of detecting a positioning error.

In the closed-loop control system, the electronic movement pulses are sent from the control unit to the servomotor, enabling the motor to rotate with each pulse. The movements are detected and counted by a feedback device called a transducer. With each step of movement, a transducer sends a signal back to the control unit, which compares the current position of the driven axis with the programmed position. When the numbers of pulses sent and received match, the control unit starts sending out pulses for the next movement.

Closed-loop systems are very accurate. Most have an automatic compensation for error, since the feedback device indicates the error and the control unit makes the necessary adjustments to bring the slide back to the position. They use AC, DC or hydraulic servomotors.

3. Drive Motors

The drive motors control the machine slide movement on NC/CNC equipment. They come in four basic types:③

(1) Stepper motors

(2) DC servomotors

(3) AC servomotors

(4) Hydraulic servomotors

Stepper motors are used in open-loop control systems, while AC, DC and hydraulic servomotors are used in closed-loop control systems.

4. Tool magazine and changers

Most of the time, several different cutting tools are used to produce a part. The tools must be replaced quickly for the next machining operation. For this reason, the majority of NC/CNC machine tools are equipped with automatic tool changers, such as magazines on machining centers and turrets on turning centers.

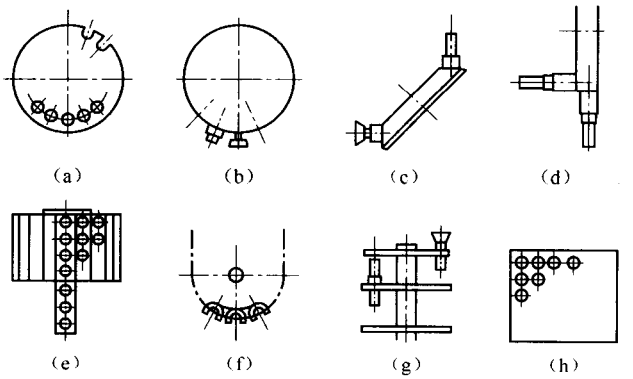

Fig. 1-9　A magazine

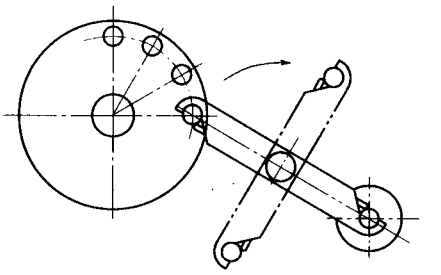

Fig. 1-10　An automatic tool changer

They allow tool changing without the intervention of the operator. Typically, an automatic tool changer grips the tool in the spindle, pulls it out, and replaces it with another tool. On most machines with automatic tool changers, the turret or magazine can rotate in either direction, forward or reverse, shown in Fig. 1-9, Fig. 1-10.

Tool changers may be equipped for either random or sequential selection. In random tool selection, there is no specific pattern of tool selection. On the machining center, when the program calls for the tool, it is automatically indexed into waiting position, where it can be retrieved by the tool-handling device. On the turning center, the turret automatically rotates, bringing the tool into position.

New Words and Phrases

assembly　*n.* 装配，组装件，集合
in general　一般地
consist　*v.* 包括，组成
binary　*adj.* 二进制的
impulse　*n.* 脉冲
sensing　*n.* 传感器
graduate　*n.* 刻度
servomotor　*n.* 伺服电机
tool path　刀具路径
minicomputer　*n.* 微型计算机
tedious　*adj.* 烦琐的
intersection　*n.* 交点
processor　*n.* 处理器
feed back　反馈
discrepancies　*n.* 偏差
transducer　*n.* 传感器
DC (direct current)　直流
AC (alternative current)　交流
open loop　开环
close loop　闭环
control system　控制系统
drive　*v.* & *n.* 驱动，驾驶

hydraulic servomotors　液压伺服电机，液压马达
automatic tool changers　自动换刀机构
random selection　随机选刀
sequential selection　顺序选刀
stepper motor　步进电机
turret　*n.* 转塔刀架

Notes

① However, the programmability of the machine is dependent on whether there is a computer in the machine's control.
然而，机床程序的可用性是依赖于机床控制系统中是否有计算机。
此句中从句“whether there is a computer in the machine's control”作介词 on 的宾语从句。

② The number of pulses that the control sends to the stepper motor controls the amount of the rotation of the motor.
控制单元发送给步进电机的脉冲数控制电机的旋转角度。
此句中“that the control sends to the stepper motor”为定语从句，修饰“The number of pulses”。

③ They come in four basic types:
它们有四种基本类型：
come in：归纳起来

UNIT 2　NUMERICAL CONTROL TECHNOLOGY APPLYCATIONS

As with other expanding technologies, there is a tendency to consider numerical control as a final solution to a broad rang of manufacturing problems; However, NC application in certain manufacturing situations would be highly undesirable. The appropriate application areas for NC, based on the criteria of number of parts to be produced and their complexity.

A NC machine is most efficiently used in an environment that takes advantage of the inherent flexibility of NC. The precise level of control attributed to a numerically controlled device enables it to perform complex operations often beyond the capability of a human operator. For these reasons, numerical control is best suited to relatively low volume runs of complex and varied components. However, NC can also be used to produce large numbers of complex components and/or small numbers of simple ones.

Specific application areas for numerical control range from the manufacture of knitted fabrics to the fabrication of structural members for jet air craft. ① In the following sections we presented a brief overview of some specific applications in which NC has been utilized.

1. Metal-Cutting Machine Tools

Numerical control was introduced and developed in the metalworking industry, and the largest concentration of NC equipment remains in metalworking shops. NC has been successfully implemented for milling, drilling, grinding, boring, punching, turning, and

此为试读，需要完整PDF请访问：www.ertongbook.com