

示范性高等职业院校系列规划教材



# 数控技术专业英语

惠媛媛 王仙萌 主编

西北大学出版社

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CNC TECHNOLOGY PROFESSIONAL ENGLISH

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## 前言

数控机床在现代制造行业中的应用日益普遍,因此从事制造业的每个人都应该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,大量原版英文技术资料和 Internet 提供的国外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。

本书以提高学生专业英语的阅读能力、扩展和深化学生对本学科关键技术的认知、培养具备技术竞争力的人才为目的,本着先进、实用的选材原则和简明、系统的组织原则,充分吸收当前最新技术成果和教学成果,为数控技术专业学生提供一个提高英语水平和专业素养的平台。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,从高职教育和知识应用的实际出发,结合专业英语的教学实践来编写该教材。学生在具备一定数控专业知识的基础上,通过大量相对浅显的英文阅读获得专业英语阅读能力和英汉互译能力,加深对数控专业知识的理解。

本书共 13 个单元,从数控的职业内容与就业前景谈起,介绍了数控概念、数控机床、数控机床安全操作规程、数控机床夹具、刀具、数控加工路径、数控机床说明书、控制面板操作规程、数控编程技巧、CAD/CAM 应用、数控机床维护和故障诊断、先进制造技术等方面的数控技术专业知识。

本书在编写过程中力求体现以下特点:

1. 立足于现代制造业,针对数控技术主题,用原汁原味的英语,全面、系统地描述了数控技术相关的各类信息。介绍了数控领域的最新技术和知识,以图文并茂的方式表达,通过专业知识帮助和促进英语水平的提高。

2. 根据目前学生现有的基础水平,从实际生产应用出发,突出了数控技术专业英语词汇的专业性和内容的实用性、趣味性。

3. 各个单元配以与内容相关的插图,图文并茂,更直观,易于理解。

4. 生词加注音标,便于学生朗读,形成正确发音。

5. 课后习题着眼于专业知识,内容丰富,形式多样。

6. 书的最后列有附录,如参考译文、常用数控专业术语、专业词汇(按字母顺序列表),便于读者查询。

7. 每个单元由两部分组成:课文、辅助阅读。课文中有注释和练习题,供学生参考和复习巩固。建议每个单元用 2 个学时讲授。

本书可作为高等职业院校数控技术专业的英语教材,也可作为工程技术人员的参考阅读资料。

本书由西安航空职业技术学院惠媛媛和王仙萌担任主编,辛梅和陈芳担任副主编。参加本书编写的有:西安航空职业技术学院惠媛媛(编写10、11、13单元)、王仙萌(编写2、6、7单元)、辛梅(编写1、4、5、8单元)和陈芳(编写3、9、12单元)。

本书编写得到了有关人士的大力支持和帮助,在此表示衷心感谢!

由于编者水平有限,书中难免有错误和不妥之处,敬请读者批评指正。

编 者

2009年6月

# Contents

<b>Unit 1 What Computer Control Programmers and Operators Do</b>	( 1)
Part A Text	( 1)
Part B Supplementary Reading	( 6)
<b>Unit 2 The History of CNC and NC Development</b>	( 8)
Part A Text	( 8)
Part B Supplementary Reading	( 11)
<b>Unit 3 NC machine</b>	( 13)
Part A Text	( 13)
Part B Supplementary Reading	( 16)
<b>Unit 4 Safety Notes for CNC Machine Operations</b>	( 18)
Part A Text	( 18)
Part B Supplementary Reading	( 20)
<b>Unit 5 Jigs and Fixtures</b>	( 22)
Part A Text	( 22)
Part B Supplementary Reading	( 25)
<b>Unit 6 Cutting Tools</b>	( 27)
Part A Text	( 27)
Part B Supplementary Reading	( 31)
<b>Unit 7 Continuous Path</b>	( 34)
Part A Text	( 34)
Part B Supplementary Reading	( 38)



<b>Unit 8 Operation Manual</b>	( 41)
Part A Text	( 41)
Part B Supplementary Reading	( 44)
<b>Unit 9 the Operation Panel</b>	( 47)
Part A Text	( 47)
Part B Supplementary Reading	( 51)
<b>Unit 10 Programming Techniques</b>	( 52)
Part A Text	( 52)
Part B Supplementary Reading	( 57)
<b>Unit 11 CAD/CAM and CNC</b>	( 60)
Part A Text	( 60)
Part B Supplementary Reading	( 67)
<b>Unit 12 Maintenance and troubleshooting</b>	( 69)
Part A Text	( 69)
Part B Supplementary Reading	( 74)
<b>Unit 13 Advanced Manufacturing Technology</b>	( 75)
Part A Text	( 75)
Part B Supplementary Reading	( 78)
<b>Appendix A Translation for Reference</b>	( 80)
<b>Appendix B Terms on CNC Technology</b>	( 110)
<b>Appendix C Technical Vocabulary</b>	( 113)

# Unit 1 What Computer Control Programmers and Operators Do

## Part A Text

### What Computer Control Programmers and Operators Do



Computer control programmers and operators use computer numerically controlled (CNC) machines to cut and shape precision products, such as automobile, aviation, and machine parts. CNC machines operate by reading the code included in a computer-controlled module, which drives the machine tool and performs the functions of forming and shaping a part formerly done by machine operators<sup>[1]</sup>. CNC machines include machining tools such as lathes, multi-axis spindles, milling machines, laser cutting machines, and wire electrical discharge machines. CNC

machines cut away material from a solid block of metal or plastic –known as a workpiece –to form a finished part. Computer control programmers and operators normally produce large quantities of one part, although they may produce small batches or one-of-a-kind items. They use their knowledge of the working properties of metals and their skill with CNC programming to design and carry out the operations needed to make machined products that meet precise specifications<sup>[2]</sup>.

CNC programmers – also referred to as numerical tool and process control programmers – develop the programs that run the machine tools. They review blueprints of the part and determine the sequence of events that will be needed to make the part. This may involve calculating where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove<sup>[3]</sup>.

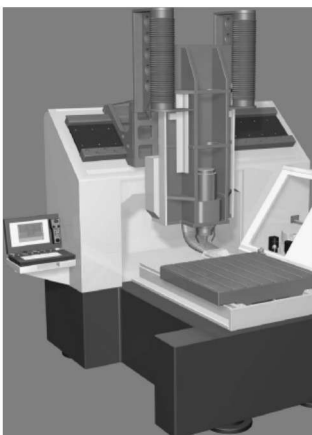
Next, CNC programmers turn the planned machining operations into a set of instructions. These instructions are translated into a computer aided/automated manufacturing (CAM) program containing a set of commands for the machine to follow. These commands normally are a series of numbers that describes where cuts should occur, what type of cut should be used, and the speed



of the cut. After the program is developed, CNC programmers and operators check the programs to ensure that the machinery will function properly and that the output will meet specifications. Because a problem with the program could damage costly machinery and cutting tools or simply waste valuable time and materials, computer simulations may be used to check the program before a trial run<sup>[4]</sup>. If errors are found, the program must be changed and retested until the problem is resolved. In addition, growing connectivity between CAD/CAM software and CNC machine tools is raising productivity by automatically translating designs into instructions for the computer controller on the machine tool. These new CAM technologies enable programs to be easily modified for use on other jobs with similar specifications.

After the programming work is completed, CNC operators – also referred to as computer-controlled machine tool operators – set up the machine for the job. They download the program into the machine, load the proper cutting tools into the tool holder, position the workpiece on the CNC machine tool – spindle, lathe, milling machine, or other machine – and then start the machine<sup>[5]</sup>. During the test run of a new program, the operator, who may also have some programming skills, or the CNC programmer closely monitors the machine for signs of problems, such as a vibrating workpiece, the breakage of cutting tools, or an out-of-specification final product. If a problem is detected, a setup operator or CNC programmer will modify the program using the control module to eliminate the problems or to improve the speed and accuracy of the program.

Operators load workpieces and cutting tools into a machine, press the start button, monitor the machine for problems, and measure the parts produced to check that they match specifications. If they encounter a problem that requires modification to the cutting program, they shut down the machine and wait for a more experienced CNC setup operator to fix the problem. Many CNC operators start at this basic level and gradually perform more setup tasks as they gain experience.



Regardless of skill level, all CNC operators detect some problems by listening for specific sounds – for example, a dull cutting tool that needs changing or excessive vibration<sup>[6]</sup>. Machine tools rotate at high speeds, which can create problems with harmonic vibrations in the workpiece. Vibrations cause the machine tools to make minor cutting errors, hurting the quality of the product. Operators listen for vibrations and then adjust the cutting speed to compensate. CNC operators also ensure that the workpiece is being properly lubricated and cooled, because the machining of metal products generates a significant amount of

heat.

A single operator may monitor several machines simultaneously. Typically, an operator might monitor two machines cutting relatively simple parts from softer materials, while devoting most of his or her attention to a third machine cutting a much more difficult part from hard metal, such as stainless steel. Operators are often expected to carefully schedule their work so that all of the machines are always operating.

### Technical words and phases

programmer [ˈprəʊgræmə]	n. 程序员
operator [ˈɒpəreɪtə]	n. 操作人员
automobile [ˈɔ:təməʊbi:l, ɔ:təubil, ɔ:təməˈbi:l]	n. 汽车
aviation [ˌeɪvɪˈeɪʃən]	n. 航空, 航空学
module [ˈmɒdju:l]	n. 模件, 组件, 程序片, 指令组
perform [pəˈfɔ:m]	vt. 履行, 执行, 完成(事业), 进行
lathe [leɪð]	n. 【机】车床
material [məˈtɪəriəl]	n. 物质; 原料; 材料
workpiece [ˈwɜ:kpi:s]	n. 工件; 加工件
batch [bætʃ]	n. 一次所制之量, 一组, 批, 成批, 分批 vt. 成批, 分批处理 vi. 成批, 分批处理
precise [priˈsaɪs]	adj. 精确的, 准确的
specification [ˌspesɪfɪˈkeɪʃən]	n. 规格, 详述, 详细说明书
metal [ˈmetl]	n. 金属; 金属制品
remove [riˈmu:v]	vt. 移动, 去除, 切[锉, 磨]掉
trial [ˈtraɪəl]	n. 试验, 试用, 试车
automatically [ɔ:təˈmætɪkli]	adv. 自动地
modify [ˈmɒdɪfaɪ]	vt. 变更, 修改
monitor [ˈmɒnɪtə]	n. 监视器 vt. 监视, 监听, 监督 vi. 监视, 监听, 监督
vibrate [vaɪˈbreɪt]	vi. 振[震, 颤, 摆]动
compensate [ˈkɒmpənseɪt]	vt. 补偿, 偿还, 均[平]衡, 校正
lubricate [ˈlu:brikeɪt]	vt. 使润滑, 加润滑油 vi. 润滑

schedule [ˈʃedju:l; ˈskedʒjul]	n. 时间表, 一览表, 计划表, 议事日程 vt. 预定, 编制目录, 制...表, 安排
milling machine	铣床
laser cutting machine	激光切割机
wire electrical discharge machines	线切割机
computer simulation	计算机仿真
tool holder	夹头
out-of-specification	超差
computer numerically control	计算机数控
stainless steel	不锈钢

## Notes

(1) CNC machines operate by reading the code included in a computer-controlled module, which drives the machine tool and performs the functions of forming and shaping a part formerly done by machine operators.

以前由操作工完成的切割、成型工作可由数控机床执行包含在计算机控制模块中的代码来完成。

(2) They use their knowledge of the working properties of metals and their skill with CNC programming to design and carry out the operations needed to make machined products that meet precise specifications.

数控程序员和操作员们用他们的金属加工知识和数控编程技巧完成工艺设计和加工, 使加工的产品满足精度要求。

(3) This may involve calculating where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove.

这可能涉及计算切削和钻孔的位置、进给速度和切削量等。

(4) Because a problem with the program could damage costly machinery and cutting tools or simply waste valuable time and materials, computer simulations may be used to check the program before a trial run.

程序上的问题会毁坏昂贵的机器和刀具, 或浪费宝贵的时间和材料, 因此计算机仿真可在机器运行前检查程序正确与否。

(5) They download the program into the machine, load the proper cutting tools into the tool holder, position the workpiece on the CNC machine tool – spindle, lathe, milling machine, or other machine – and then start the machine.

他们将程序导入机器, 安装工具到刀柄, 固定工件于钻床、车床、铣床或其他机床, 然后启动机器。

(6) Regardless of skill level, all CNC operators detect some problems by listening for specific sounds –for example, a dull cutting tool that needs changing or excessive vibration.

无论技术水平, 所有操作员都通过声音判断某些问题的出现, 例如, 刀具变钝需要更换或振动过大。

## Exercises

### I. Questions for discussion.

1. What is CNC?
2. How do CNC programmers do while machining?
3. What's the CNC operators' work?

### II. Put the following into Chinese.

1. CNC machines cut away material from a solid block of metal or plastic – known as a workpiece –to form a finished part.

2. Computer control programmers and operators normally produce large quantities of one part, although they may produce small batches or one-of-a-kind items.

3. After the program is developed, CNC programmers and operators check the programs to ensure that the machinery will function properly and that the output will meet specifications.

4. If a problem is detected, a setup operator or CNC programmer will modify the program using the control module to eliminate the problems or to improve the speed and accuracy of the program.

5. CNC operators also ensure that the workpiece is being properly lubricated and cooled, because the machining of metal products generates a significant amount of heat.

### III. Writing.

1. Title: Personal resume of yourself.
2. Time limit: 45 minutes.
3. Words limit: 120 ~ 200 words.

## Part B Supplementary Reading

### Job Opportunities Related to CNC

There is quite a shortage of skilled people to utilize CNC machines. And the shortage is



growing. Everywhere I go I hear manufacturing people claiming that they cannot find skilled people. Unfortunately, it has also been my experience that pay scales have not yet reflected this shortage. Even so, you can make a good wage and develop a rewarding career working with CNC machines.

#### Employment

Computer control programmers and operators held about 158 000 jobs in 2006. About 89 percent were computer-controlled machine tool operators, and about 11 percent were numerical tool and process control programmers. Manufacturing employs almost all of these workers. Employment was concentrated in fabricated metal products manufacturing, machinery manufacturing, plastics products manufacturing, and transportation equipment manufacturing making mostly aerospace and automobile parts. Although computer control programmers and operators work in all parts of the country, jobs are most plentiful in the areas where manufacturing is concentrated.

#### Job Outlook

Despite the projected slow decline in employment of computer control programmers and operators, job opportunities should be excellent, as employers are expected to continue to have difficulty finding qualified workers.

#### Employment change

Employment of computer control programmers and operators is expected to by 4 percent through 2016. While CNC machine tools will be increasingly used, advances in CNC machine tools and manufacturing technology will further automate the production process, boosting CNC operator productivity and limiting employment. The demand for computer control programmers also will be negatively affected by the increasing use of software ( CAD/CAM) that automatically translates part and product designs into CNC machine tool instructions.

**Job prospects**

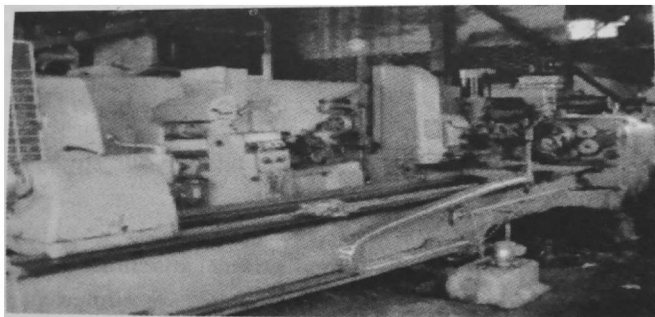
Computer control programmers and operators should have excellent job opportunities despite the projected slow decline in employment. Due to the limited number of people entering training programs, employers are expected to continue to have difficulty finding workers with the necessary skills and knowledge.

## Unit 2 The History of CNC and NC Development

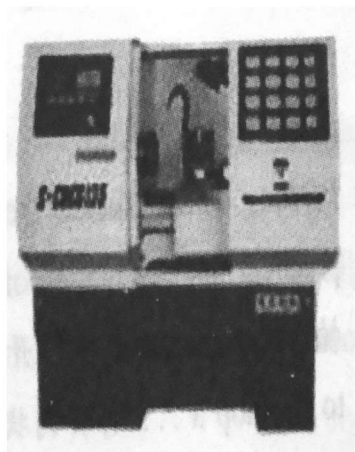
### Part A Text

#### The History of CNC and NC Development

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. The NC concept was proposed in the late 1940s by John Parsons of Traverse City, Michigan. Parsons recommended a method of automatic machine control that would guide a milling cutter to produce a “thru-axis curve” in order to generate smooth profiles on work pieces.



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<sup>[1]</sup>. 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). Computers are the control units of CNC machines, they are built in or linked to the machines via communications channels. When a programmer input some information in the program by tape and so on, the computer calculates all necessary data to get the job done.

On the first numerically controlled (NC) machines, numerical data was controlled by tape, and because of that, the NC systems were known as tape-controlled machines<sup>[2]</sup>. 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, work principles are the same. Only the way in which the execution is controlled is different. Normally, new systems are faster, more powerful, and more versatile<sup>[3]</sup>.

### Technical words and phases

numerical [nju(:) 'merikəl]	adj. 数字的, 用数表示的
operation [ɒpə'reɪʃən]	n. 运转, 操作, 实施
implementation [ɪmplɪmen'teɪʃən]	n. 执行
profile ['prəʊfaɪl]	n. 剖面, 侧面, 外形, 轮廓
mature [mə'tjuə]	adj. 成熟的, 到期的 vt. 使成熟
calculate ['kælkjuleɪt]	v. 计算, 考虑, 计划
punch [pʌntʃ]	n. 冲压机, 冲床, 打孔机 vt. 冲孔, 打孔
versatile ['vɜ:sətaɪl]	adj. 通用的, 万能的
milling cutter	铣刀
machine tool	机床
hard-wire	硬线连接
magnetic tape	磁带
machining center	加工中心
electric discharge machine (EDM)	电火花机床
recommendation for...	关于……的推荐值

### Notes

(1) Parsons commissioned the Massachusetts Institute of Technology (M. I. T) to develop a practical implementation of his concept.



帕森委托麻省理工学院开发他设想中的实用机器。

(2) On the first numerically controlled ( NC ) machines, numerically data was controlled by tape and because of that, the NC systems were known as tape-controlled machines.

在最初的 NC 机床上,其数据由磁带提供及控制,因此这种数控系统被称为磁带控制机。

(3) Normally, new systems are faster, more powerful, and more versatile.

一般说来,新系统加工速度更快,功率更大,功能更强。

## Exercises

### I. Work with your partner to answer the following questions.

1. What is the definition of NC & CNC?
2. Who proposed the NC concept in 1940s?
3. Give the list of NC/CNC technology in application.

### II. Mark the following statements with T( true) or F( false) according to the text.

1. In 1950s, scientists and engineers at MIT built a control system for a two-axis milling machine that used microphone as the input tool. ( )
2. Computer-based NC became widely used in industry in 1970s because the major machine tool manufacturers were producing some machines with NC. ( )
3. The work principles of NC/CNC system are the same and the way of execution is different. ( )

### III. Review the text and translate the following phrases into Chinese or English.

1. 加工中心
2. 铣刀
3. 机床
4. numerical control
5. milling machine

### IV. Translate the following sentences into Chinese.

1. NC matured as an automation technology when inexpensive and powerful microprocessors replaced hard-wire logic-making computer-based NC systems.
2. Parsons recommended a method of automatic machine control that would guide a milling cutter to produce a “thru-axis curve” in order to generate smooth profiles on work pieces.