



普通高等教育“十一五”国家级规划教材
新编高等职业教育电子信息、机电类规划教材



数控技术应用专业

数控技术专业英语

(第3版)

汤彩萍 编著

Specialized English for CNC Technology
(Third Edition)

教材特色与亮点:

- 取材英美文献, 含数控机床编程操作维护内容
- 以典型数控FANUC系统为学习载体, 迎合读者需求
- 大容量图片, 内容直观, 专业可视
- 习题丰富, 反复训练, 获得专业英语综合能力
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Authored by Tang Caiping

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Publishing House of Electronics Industry

北京·BEIJING

内 容 简 介

本书是一本英文版的数控技术入门教材,主要介绍数控基础、数控机床、数控操作与编程、金属切削加工与刀具、CAD/CAM 应用、数控机床维护、自动化工厂、数控产品营销等方面的数控技术知识。本书取材基本上源于英美文献原著、美国数控机床制造厂商文件以及网上提供的最新技术信息。文章内容新颖,文笔流畅,图文并茂,采用简单形象的比喻来说明数控机床的工作原理和功能,具有一定的趣味性。为了训练学习者用英语获得专业信息的能力,各单元都配有大量的习题。同时,为了帮助读者顺畅地阅读英文资料,本书还介绍科技英语翻译的一般技巧。

本书可作为高等职业院校数控技术应用类专业、机电一体化类专业的教材,也可作为机械制造业及自动化领域有关技术人员或销售人员的参考书。

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图书在版编目(CIP)数据

数控技术专业英语/汤彩萍编著. —3 版. —北京:电子工业出版社,2013.7

新编高等职业教育电子信息、机电类规划教材·数控技术应用专业

ISBN 978-7-121-20850-8

I. ①数… II. ①汤… III. ①数控技术-英语-高等职业教育-教材 IV. ①H31

中国版本图书馆 CIP 数据核字(2013)第 145173 号

策 划:陈晓明

责任编辑:郭乃明 特约编辑:张晓雪

印 刷:北京京科印刷有限公司

装 订:北京京科印刷有限公司

出版发行:电子工业出版社

北京市海淀区万寿路 173 信箱 邮编 100036

开 本:787×1 092 1/16 印张:16 字数:410 千字

印 次:2013 年 7 月第 1 次印刷

印 数:3 000 册 定价:33.00 元

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前 言

今天,从乡镇企业的小车间到大城市的 500 强企业,数控机床无处不在。这些创新性的机床触及制造业的方方面面,因此从事制造业的每个人都必须很清楚这些复杂的机床的功能。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 and Internet 提供的最新技术信息与动态,使得英语的掌握对于专业技术的学习和提高有着举足轻重的作用。

专业英语课程同高职院校的其他课程一样,注重实践性和应用性,讲究能力的训练。作为技术语言类课程,其实践性不仅仅体现在专用的实验实训设备上,更应通过大量的阅读、大量的习题训练来体现。题干为专业知识的任务型习题不仅能够培养学生英语应用能力和解决实际问题的能力,而且体现了用英语学技术的双语教学理念。

本教材采用项目教学思想组织,分数控就业、数控概念、数控基础、数控机床、插补类型、补偿类型、编程结构、CAD/CAM、高速加工、数控操作、数控机床维护、自动化工厂、数控营销等 13 个项目,涵盖数控相关技术及其涉及的语言点和词汇。

在第 3 版的编写过程中,力求体现下列特点:

1. 取材基本上源于英美文献原著、美国数控机床制造厂商文件以及网上提供的最新技术信息。编写时对原文只作删节,不作改写。对选取的文章,力求文笔流畅,用简单形象的比喻来说明数控机床的工作原理和功能,具有一定的趣味性,让读者感觉轻松。

2. 较第 1、2 版增加了大容量的图片和习题,提高了内容的直观性和专业的可视性,使自主学习更有可能。采用具体的机床数控产品为例,相关信息在习题中以背景资料的形式出现,图文并茂,帮助学生克服专业理解的困难。习题形式多样,重点设计了工作任务式习题,考查学生的专业英语应用能力。

3. 由于数控操作是数控专业英语学习中最有效的学习项目,而 FANUC 系统是中国车间使用最多、各院校最易得的数控设备,因此在第 3 版中,一改第 1、2 版中以 HAAS 系统作为学习载体,代之以 FANUC 系统的面板学习及操作,迎合了绝大多数读者的需求。

4. 在语境中学习词汇。采取在上下文中找近义词、反义词等方式,或在一定的语境下进行词类形式的变换,或用英语解释专业词汇的方式锻炼学生“think in English”的能力,实用性强。

5. 书的最后列附录,如将常用缩略语、专业词汇按字母顺序列表,便于读者查询。

6. 结合教学内容,穿插介绍专业英语翻译的基本技巧。

本书的读者群是将来直接从事数控机床工作的人员,学完本书,读者将对数控机床的功能、原理和使用有一个良好的理解。本书也适合将来并不直接与数控设备打交道的人员,学完本书,这些读者将对数控技术具备一些实用性的知识,能够顺畅地与同行交流数控机床方面的业务。

本书还配套有教师授课用电子课件、原版录像、习题解答等教学资源,教师可发邮件至 tangaipingtcp@163.com 索取。本书电子课件可在华信教育资源网上免费下载。

本书得到美籍外教 Satina Anziano 女士的大力支持,在此表示感谢。

由于编者水平有限,敬请读者批评指正!

编 者

2013 年 2 月

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Unit

1

What computer-control programmers and operators do



Warm-up questions

1. *In your sense, what do computer-control programmers and operators do?*
2. *How much do you know about the employment opportunities related to CNC?*

Part A Text

Computer-control programmers and operators use computerized numerical control (CNC) machines to cut and shape precision products, such as automobile parts, machine parts, and compressors (see fig. 1-1). CNC machines include machining tools such as lathes, multi-axis spindles, milling machines, and electrical discharge machines (EDM) (see fig. 1-2), but the functions formerly performed by human operators are performed by a computer-control module¹. CNC machines cut away material from a solid block of metal, plastic, or glass-known as a workpiece-to form a finished part². 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 specifications³.

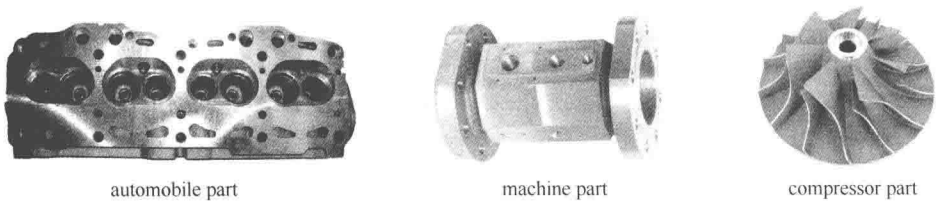


fig. 1-1 precision products

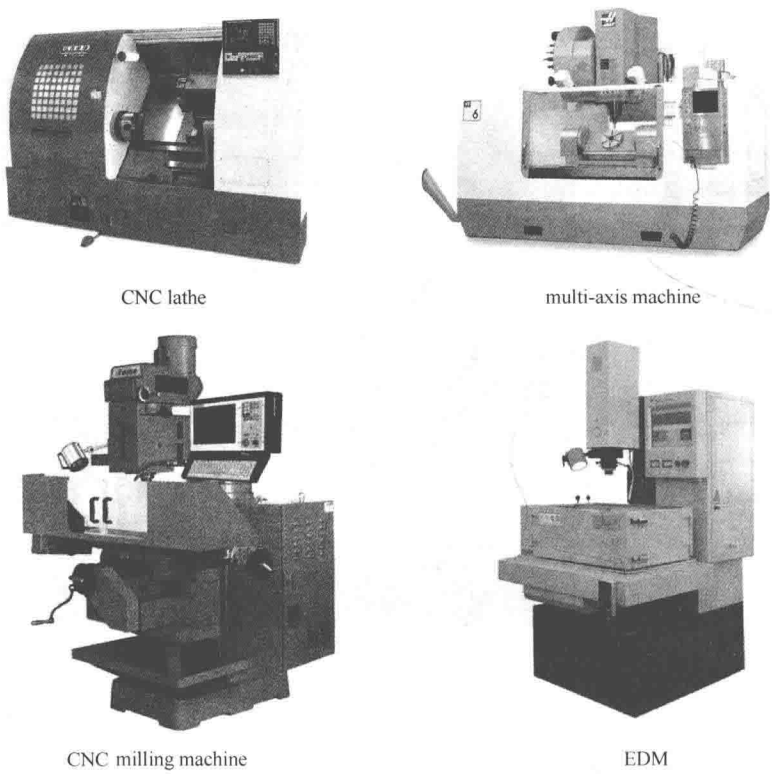


fig. 1-2 CNC machine tools

Before CNC programmers machine a part, they must carefully plan and prepare the operation⁴. First, these workers review three-dimensional computer aided design (CAD) blueprints of the part. Next, they calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove (refer to fig. 9-1). They then select tools (see fig. 1-3) and materials for the job and plan the sequence of cutting and finishing operations⁵.

Next, CNC programmers turn the planned machining operations into a set of instructions. These instructions are translated into a computer aided 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. CNC programmers and operators check new 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, computer simulations may be used to check the program instead of a trial run⁶. See fig. 1-4. 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 tool⁷. These new CAM technologies enable programs to be easily modified for use on other jobs with similar specifications.

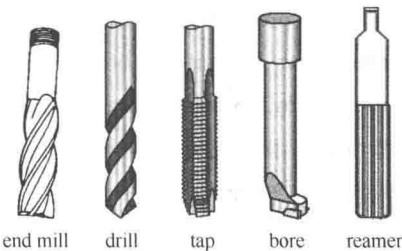


fig. 1-3 various cutting tools

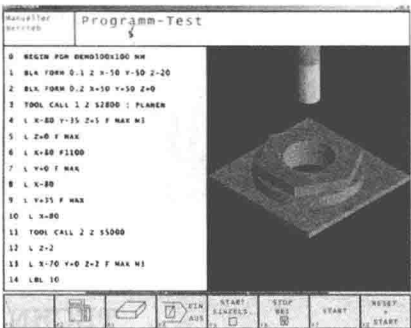


fig. 1-4 computer simulation

After the programming work is completed, CNC operators perform the necessary machining operations. The CNC operators transfer the commands from the server to the CNC control module using a computer network link or floppy disk. Many advanced control modules are conversational, meaning that they ask the operator a series of questions about the nature of the task. CNC operators position the metal stock on the CNC machine tool - lathe, milling machine, or other - set the controls, and let the computer make the cuts. During the machining process, computer-control operators constantly monitor the readouts from the CNC control module, checking to see if any problems exist. During a machining operation, the operator modifies the cutting program to account for any problems encountered. Unique, modified CNC programs are saved for every different machine that performs a task.

CNC operators detect some problems by listening for specific sounds, for example, a dull cutting tool or excessive vibration. Dull cutting tools are removed and replaced. 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. In older, slower machine tools, the cutting speed would be reduced to eliminate the vibrations, but the amount of time needed to finish the product would increase as a result. In newer, high speed CNC machines, increasing the cutting speed normally eliminates the vibrations and reduces production time. 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.

Computer-control programmers and operators can advance in several ways. Experienced CNC operators may become CNC programmers, and some are promoted to supervisory or administrative positions in their firms. A few open their own shops.

I can make a good wage and develop a rewarding career working with CNC machines.



Computer-control programmers and operators should have excellent job opportunities. 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. Job growth in both occupations will be driven by the increasing use of CNC machine tools. Advances in CNC machine tools and manufacturing technology will further automate production, boosting CNC operator productivity and limiting employment growth. The demand for computer-control programmers will be negatively affected by the increasing use of software that automatically translates part and product designs into CNC machine tool instructions.

TECHNICAL WORDS

machine	[mə'ʃi:n]	<i>n. & v.</i>	机器, 机械; 机加工
position	[pə'ziʃən]	<i>n. & v.</i>	位置, 岗位; 定位
automobile	[ɔ:təməubi:l]	<i>n.</i>	汽车
compressor	[kəm'presə]	<i>n.</i>	压缩机
programmer	[ˈprəʊgræmə]	<i>n.</i>	程序员
operator	[ɔpəreitə]	<i>n.</i>	操作员
precision	[pri'siʒən]	<i>n.</i>	精密, 精度
module	[ˈmɒdju:l]	<i>n.</i>	模块, 组件
spindle	[ˈspindl]	<i>n.</i>	主轴
solid	[ˈsɒlɪd]	<i>n.</i>	固体, 实体
block	[blɒk]	<i>n.</i>	(长方形) 块; 程序段
finish	[ˈfiniʃ]	<i>v. & ad. & n.</i>	精加工; 精细地; 表面光洁度
property	[ˈprɒpəti]	<i>n.</i>	属性, 特性
blueprint	[ˈblu:, print]	<i>n.</i>	蓝图
workpiece	[ˈwɜ:kpi:s]	<i>n.</i>	工件, 加工件
bore	[bɔ:]	<i>v. & n.</i>	镗孔, 钻孔; 镗刀
mill	[mil]	<i>v. & n.</i>	铣; 铣床; 铣刀; 工厂
specification	[ˌspesifi'keiʃən]	<i>n.</i>	规格
feed	[fi:d]	<i>n. & v.</i>	进给, 切入
job	[dʒɒb]	<i>n.</i>	工作任务, 作业, 零件活
manufacture	[ˌmænju'fæktʃə]	<i>v.</i>	制造
instruction	[in'strʌkʃən]	<i>n.</i>	指令; 指导
simulation	[ˌsimju'leɪʃən]	<i>n.</i>	模拟, 仿真

function	[ˈfʌŋkʃən]	<i>n. & v.</i>	作用, 功能; 起作用, 运行
productivity	[ˌprɒdʌkˈtɪvɪti]	<i>n.</i>	生产率
connectivity	[kəˈnekˈtɪvɪti]	<i>n.</i>	连通性, 兼容性
technology	[tekˈnɒlədʒi]	<i>n.</i>	技术
stock	[stɒk]	<i>n.</i>	毛坯, 余量; 库存
process	[ˈprəʊses]	<i>n. & v.</i>	过程, 工艺流程; 处理
readout	[riːdaʊt]	<i>n.</i>	读数, 显示值
vibration	[vaɪˈbreɪʃən]	<i>n.</i>	振动
compensate	[ˈkɒmpənseɪt]	<i>v.</i>	补偿
lubricate	[luːbrɪkeɪt]	<i>v.</i>	润滑
cool	[kuːl]	<i>v.</i>	冷却

PHRASES

be known as		称为
small batches or one-of-a-kind items		单件小批量
account for (problems)		解决 (问题)
prior to		在前, 居先
carry out	(perform)	进行, 完成
three-dimensional	(3D)	三维的
cut away	(remove)	切除
machine tool		机床
computerized numerical control	(CNC)	计算机数控
electrical discharge machine	(EDM)	电火花加工机
turning machine	(lathe)	车床
milling machine	(mill)	铣床
computer aided design	(CAD)	计算机辅助设计
computer aided manufacturing	(CAM)	计算机辅助制造
computer controller		计算机控制器, 数控系统
CNC program	(NC program)	CNC/数控 (加工) 程序
trial run		试运行
floppy disk		软磁盘
cutting tool	(cutter)	刀具
cutting speed		切削速度
finished part		成品件

NOTES

1. CNC machines include **machining tools** such as lathes, multi-axis spindles, milling machines, and electrical discharge machines (EDM), but the functions formerly performed by human operators are

performed by a computer-control module. 数控 (CNC) 机床包括车床、多轴机床、铣床和电火花机床 (EDM) 等, 只不过以前由人工完成的功能现在由计算机控制模块完成。这里 *machining tools* 中的 *machine* 作为动词用 (*machining* 是其动名词形式), 是机加工的意思, 机床是制造各种机器的工具, 被称为工作母机, 因此英语里 “机床” 往往用 “*machine tool*” 来表达。

2. CNC machines cut away material from a solid block of metal, plastic, or glass - known as a workpiece - to form a finished part. 数控机床从整块的金属、塑料或玻璃实体 (称为工件) 上切除材料, 形成成品件。

3. 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**. 他们运用其金属材料特性方面的知识和数控编程方面的技能进行设计和加工, 制造满足精度要求的机加工产品。*needed* 为过去分词, 作后置定语, 修饰 *operations*; *that meet precise specifications* 是定语从句, 说明 *products*; *machined* 为过去分词, 作前置定语修饰 *products*。

4. Before CNC programmers machine a part, they must carefully plan and prepare the operation. 在数控程序员加工零件之前, 他们必须对整个加工过程进行仔细的规划和准备。

5. First, these workers review three-dimensional computer aided design (CAD) blueprints of the part. Next, they calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove. They then select tools and materials for the job and plan the sequence of cutting and finishing operations. 首先, 这些工人查看零件的三维计算机辅助设计 (CAD) 图纸; 接下来, 他们计算切入或钻入工件的位置、工件的进给速度、金属的去除量; 然后, 他们选择适合工件的刀具和材料, 制定粗加工和精加工操作的顺序。

6. Because a problem with the program could damage costly machinery and cutting tools, computer simulations may be used to check the program instead of a trial run. 因为程序有问题会对机床和刀具造成极大的损坏, 因此可用计算机仿真的方法检查程序的正确性, 而不用试运行的方法。

7. 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. 另外, CAD/CAM 软件与数控机床之间的联系日益紧密, CAD/CAM 软件能自动将设计结果转换成机床的计算机控制器能接受的指令, 这大大提高了生产率。参见 UNIT 8。

Part B Practice

I. Translate the following words or phrases into English.

- | | |
|---------|--------------|
| 1. 精密产品 | 2. 加工零件 (v.) |
| 3. 精加工 | 4. 切入点 |
| 5. 进给速度 | 6. 工件、作业 |
| 7. 更换刀具 | 8. 符合规格 |
| 9. 修改程序 | 10. 解决问题 |
| 11. 车床 | 12. 铣床 |
| 13. 镗床 | 14. 电火花加工机 |

15. 数控机床
17. 数控编程 (员)
19. 冷却 (n.)
21. 强烈的振动
23. 完成功能 (v.)

16. 数控系统
18. 数控操作 (员)
20. 润滑 (n.)
22. 金属毛坯
24. 完成操作 (v.)

II. Fill in the blanks with the following words, changing their forms if necessary.

CAD, CAM, CNC, EDM, calculate, select, review, translate

1. _____ uses all the advanced technologies to automate the operations in manufacturing and handle the data that drive the process.
2. _____ is a television like system that produces a picture on the CRT or LCD screen.
3. First, these workers _____ three-dimensional computer aided design (CAD) blueprints of the part. Next, they _____ where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove. They then _____ tools and materials for the job and plan the sequence of cutting and finishing operations.
4. _____ is the process of removing metal through the use of electrical sparks which burn away the metal.
5. _____ is one in which the functions and motions of a machine tool are controlled by means of a prepared program containing coded alphanumeric (字母数字) data.

III. Choose the best answer.

1. The first thing for a CNC programmer is:
 - A. To review three-dimensional computer aided design (CAD) blueprints of the part
 - B. To calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine, and how much metal to remove
 - C. To select tools and materials for the job and plan the sequence of cutting and finishing operations
2. Because a problem with the program could damage costly machinery and cutting tools, what may be firstly used to check the program?
 - A. A trial run
 - B. The single-block run
 - C. Computer simulations

Your answer: _____

3. The proper sequence of performing the necessary machining operations for a CNC operator is as the following:

① transfers the commands from the server to the CNC control module using a computer network link or floppy disk.

② sets the controls

③ positions the metal stock on the CNC machine tool

④ monitors the machining process

⑤ lets the computer make the cuts

A. ①→③→②→⑤→④

B. ①→②→④→③→⑤

C. ①→②→③→④→⑤

Your answer: _____

4. Sounds in the CNC machine are probably caused by:

A. A dull cutting tool

B. High speeds

C. Either a dull cutting tool or high speeds

Your answer: _____

5. Cutting speeds are reduced to compensate for harmonic vibrations, which can _____ the accuracy (精度) of cuts.

A. Increase

B. Decrease

C. Neither of the above

Your answer: _____

IV. Fill in the brackets with words that have the similar meaning with the underlined words, changing their forms if necessary.

1. () During a machining operation, the operator modifies the cutting program to account for any problems encountered.

2. () Because a problem with the program could damage costly machinery and cutting tools, computer simulations may be used to check the program instead of a trial run.

3. () If errors are found, the program must be changed and retested until the problem is resolved.

4. () Conversational programming means that the control asks the operator a series of questions about the nature of the task.

5. () These new CAM technologies enable programs to be easily modified for use on other jobs with similar specifications.

6. () CNC programmers turn the planned machining operations into a set of instructions.

7. () Machine tools rotate at high speeds, which can create problems with harmonic vibrations in the workpiece.

8. () 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.

9. () Machinists use machine tools, such as lathes, milling machines, and

machining centers, to produce precision metal parts.

10. () Machinists use machine tools, such as lathes, milling machines, and machining centers, to produce precision metal parts.

11. () 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.

12. () Because a problem with the program could damage costly machinery and cutting tools, computer simulations may be used to check the program instead of a trial run.

13. () These workers review three-dimensional computer aided design (CAD) blueprints of the part.

14. () After the programming work is completed, CNC operators perform the necessary machining operations.

15. () Computer-control programmers and operators normally produce large quantities of one part.

V. Choose the correct English explanation for each of the following words.

1. Lathe

- A. is a machine that turns a piece of metal round and round against a sharp tool that gives it shape.
- B. is the motion of moving the work piece and the cutting tool together so as to remove material.
- C. is the operation of enlarging a hole with a single-point tool. This operation produces a close tolerance (公差) and fine (精细的) finish.

Your answer: _____

2. Milling machine

- A. is a machine that turns a piece of metal round and round against a sharp tool that gives it shape.
- B. is a machine that removes metal through the use of electrical sparks (电火花) which burn away the metal.
- C. is a machine tool that removes material by rotating a cutter and moving into the material. It is used to produce flat and angular surfaces, grooves (槽), contours (轮廓), and gears.

Your answer: _____

3. Boring

- A. is a machine that turns a piece of metal round and round against a sharp tool that gives it shape.
- B. is the process or technique of reducing wear (磨损) between surfaces by using a lubricant (润滑剂) between the surfaces.
- C. is the operation of enlarging a hole with a single-point tool. This operation produces a close tolerance and fine finish.

Your answer: _____

4. Feed

- A. is the motion of moving the work piece and the cutting tool together so as to remove material.
- B. is the process or technique of reducing wear between surfaces by using a lubricant between the surfaces.
- C. is the operation of enlarging a hole with a single-point tool. This operation produces a close tolerance and fine finish.

Your answer: _____

5. CNC

- A. is a special liquid that performs three main functions during machining. It lubricates the cutting action, carries off the heat generated, and flushes (冲洗) the chips (切屑).
- B. is a form of programmable automation in which the machine tool is controlled by a program in computer memory.
- C. is the process of removing metal with machine tools such as lathes, mills and a wide variety of other tools.

Your answer: _____

6. Lubrication

- A. is the process or technique of reducing wear between surfaces by using a lubricant between the surfaces.
- B. is a special liquid that performs three main functions during machining. It lubricates the cutting action, carries off the heat generated, and flushes the chips.
- C. is the material being machined. It can be any material and any shape. In the machine shop it usually refers to round or flat pieces of metal ready to be machined.

Your answer: _____

7. Coolant

- A. is the process or technique employed to reduce wear between surfaces by using a lubricant between the surfaces.
- B. is a special liquid that performs three main functions during machining. It lubricates the cutting action, carries off the heat generated, and flushes the chips.
- C. is the material being machined. It can be any material and any shape. In the machine shop it usually refers to round or flat pieces of metal ready to be machined.

Your answer: _____

8. Stock

- A. is the process or technique employed to reduce wear between surfaces by using a lubricant between the surfaces.
- B. is that portion (一部分) of a machine tool that spins (旋转) either the workpiece or the cutting tool and is driven by the motor. On a milling machine it turns within the quill (套筒) while on a lathe it turns within the headstock (床头箱).

C. is the material being machined. It can be any material and any shape. In the machine shop it usually refers to round or flat pieces of metal ready to be machined.

Your answer: _____

9. Spindle

A. is a special liquid that performs three main functions during machining. It lubricates the cutting action, cools the cutting action, and flushes the chips.

B. is that portion of a machine tool that spins either the workpiece or the cutting tool and is driven by the motor. On a milling machine it turns within the quill while on a lathe it turns within the headstock.

C. is the material being machined. It can be any material and any shape. In the machine shop it usually refers to round or flat pieces of metal ready to be machined.

Your answer: _____

10. Machining

A. is a person who uses machine tools to make or modify parts, primarily metal parts.

B. is the process of removing metal with machine tools such as lathes, mills and a wide variety of other tools.

C. is the piece of metal that is being shaped.

Your answer: _____

VI. The following information relates to what machinists do. Match Column A with Column B.

Column A	Column B
use	feeds and speeds
produce	machine tools
review	the specification
calculate	the metal stock
position	blueprints
set	problems
monitor	dull tools
detect	the machining
replace	the controls
meet	parts

VII. Answer the following questions according to the text.

1. After reading the text, can you tell what computer-control programmers and operators do? Use your own words to conclude the working procedures.
