中等职业教育国家规划教材
全国中等职业教育教材审定委员会审定

机电专业英语

（数控技术应用专业）

鲍海龙 主编

机械工业出版社

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机械工业出版社

本书由科普篇、机电技术基础篇和应用篇组成，内容主要选自进口设备的说明书。其中，科普篇和机电技术基础篇主要包括计算机、机械工程、机电技术、CAD/CAM 软件技术等组成；应用篇主要包括机电技术在机械等方面的应用，如数控机床的相关技术。

本书是针对广大职业技术院校学生毕业后实际工作需要而编写的，具有实用、适用、针对性强等特点。本书适合作为机电技术的职业技术院校的机械、数控、机电技术和机电维修等专业的专业英语教材，也可供机械、数控、机电技术专业技术人员学习参考。

图书在版编目（CIP）数据

机电专业英语/鲍海龙主编 .—北京：机械工业出版社，2002.5
中等职业教育国家规划教材
ISBN 7-111-09889-7

Ⅰ.机… Ⅱ.鲍… Ⅲ.机电工程—英语—专业学校—教材 Ⅳ.H31

中国版本图书馆 CIP 数据核字（2002）第 009272 号

机械工业出版社（北京市百万庄大街 22 号 邮政编码 100037）
责任编辑：邓海平 版式设计：冉晓华 责任印制：路 琳
北京机工印刷厂印刷·新华书店北京发行所发行
2002 年 3 月第 1 版·第 1 次印刷
787mm×1092mm 1/16·6.75 印张·161 千字
0 001—4 000 册
定价：8.00 元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换
本社购书热线电话（010）68993821、68326677-2527

前　言

本书是教育部“面向21世纪职业教育改革”规划教材之一。本书是严格按照已经教育部审查通过的《机电专业英语》教学大纲编写的。

本书由科普篇、机电技术基础篇、应用篇组成。全书共计30课，其中科普篇6课，机电技术基础篇10课，应用篇14课。内容主要以新技术、新知识为主，主要由计算机技术、机械工程技术、机电一体化技术、CAD/CAM等组成。其中应用篇主要选自从国外进口的先进的机电一体化设备的使用说明书、设备的维护维修手册、编程和操作说明书等。

本书具有实用性、适用性和针对性的特点。实用性是指在全书课文的内容的选择方面，主要选择一些目前工程实际中普遍使用的新知识、新技术，使学生学习后，不仅学习了语言，而且在工程实践中学有所用。适用性是指本书的内容是和职业技术学校的学生学习。针对性是指针对职业技术院校的学生特点而编写。

本书可供职业技术院校的机械、数控、机电技术、机电维修专业的学生使用。在教学中，各院校可根据各校的实际情况，调整授课顺序或删减有关内容。本书作为教材的教学时数推荐为64学时。

本书由辽宁机电职业技术学院鲍海龙主编，参加编写的人员有四川工程职业技术学院的冯锦春、辽宁机电职业技术学院的姜雁。四川工程职业技术学院的陈洪涛和周奎也编写了部分内容。在编写过程中，得到了辽宁机电职业技术学院、四川工程职业技术学院的领导和同志们的大力支持和帮助。

本书由四川工程职业技术学院的司徒渝院长审阅。参加审稿的有湖南工业职业技术学院的董建国、福建高级工业专门学校的朱志宏、廊坊市工业学校的陈继镇、贵州省机械工业学校的张黔成、大连职业技术学院的田春霞等同志。在此，对于在本书编写工程中付出过辛勤劳动的所有同志表示衷心感谢。

由于我们水平有限，加上时间紧迫，经验不足，书中难免会有缺点和错误，欢迎读者批评。

编　者

于丹东

目　　录

Part 1 General Science

Lesson 1 Computers

A computer is an electronic machine that performs calculations and processes data automatically at high speed according to a prescribed sequence of operations. Broadly speaking①, the term can refer not only to an electronic machine but also to one of a mechanical, analog, or other variety. Although all these types are used, computers usually means electronic digital machines because electronic digital machines have many advantages and are widely used. Computers vary greatly in size; the smallest can be incorporated into a wristwatch, while the largest may fill an entire room. The electronic computers of computers enable them to perform operations at high speeds. The fastest computer is able to perform billions of calculations per second. Computers are used to solve numerous problems, such as payroll calculations, inventory records, bank account transactions, airline reservations, and scientific and engineering computations. For each problem, the user must supply the necessary data and prepare an appropriate program (sequence of operations) by which the computer can process the data to produce the desired output②

New Words and Phrases:

1. prescribe [pri 'skraib] v. 指示，规定
2. sequence ['si:kwəns] n. 次序，顺序，序列
3. term [tə:m] n. 学期，术语
4. mechanical [mi 'kænik(ə)l] adj. 机械的，机械制的
5. analog ['ænəlɔg; (*US*) 'ænəlɔ:g] n. 类似物，相似体
6. electronic [ilek 'trɔnik] adj. 电子的
7. digital ['didʒit(ə)l] adj. 数字的
8. advantage [əd 'və:ntidʒ] n. 优势，有利条件，利益
9. incorporatad [in 'kɔ:pəreitid] adj. 合成一体的
10. wristwatch ['ristwɔtʃ] n. 手表
11. inventory ['invəntəri] n. 详细目录，总量
12. transaction [træn 'zækʃ(ə)n] n. 办理，处理，处理事务
13. reservation [rezə 'veiʃ(ə)n] n. 保留，预定，预约
14. appropriate [ə 'prəuprieit] adj. 适当的

Notes:

1. Broadly speaking...：广义上说...

2. For each problem, ... program (sequence of operations) by which the computer....: 此句中的 by which 引导了定语从句用于说明 program。

Reading:

History of Computer

Let us take a look at the history of the computers that we know today. The very first calculating device used was the ten fingers of a man's hands. During the 17th and 18th centuries many people tried to find easy ways of calculating. The first real calculating machine appeared in 1820 as the result of several people's experiments. In 1930, the first analog computer was built by an American named Vannevar Bush. The first generation of computers, which used vacuum tubes, came out in 1950. Univac Ⅰ is an example of these computers which could perform thousands of calculations per second. In 1960, the second generation of computers was developed and these could perform work ten times faster than their predecessors. The reason for this extra speed was the use of transistors instead of vacuum tubes. The third-generation computers appeared on the market in 1965. These computers could do a million calculations a second, which is 1000 times as many as first-generation computers. Fourth-generation computers have now arrived, and the integrated circuits that are being developed have been greatly reduced in size. Fourth-generation computers are 50 times faster than third-generation computers and can complete approximately 1,000,000 instruction per second.

Lesson 2 PTC① Engineering Solutions

Pro/ENGINEER is the industry's de facto standard 3D mechanical design suite.②It contains patent-pending, award-winning technology that helps designers and engineers create superior products more quickly.③ It is based on Granite One, the industry's most robust, parametric, feature-based architecture-so wholesale design changes can be made with confidence.④Direct Modeling TM and the certified Windows user-interface make learning and using a breeze.⑤With associative applications,⑥robust responsiveness and web connectivity, Pro/ENGINEER is the ideal engineering solution to accelerate product development. To find out more and why Pro/ENGINEER is engineered for innovation, read the Product Line Overview.

Pro/ENGINEER Solutions include

- Fully?? functional entry level CAD with Pro/ENGINEER-Foundation
- Pro/ENGINEER 2000I"Student Edition
- Design Solutions (CAD)
- Styling and Industrial Design (CAID)
- Production Solutions (CAM)
- Simulation Solutions (CAE)
- Visualization Solutions (Viz)
- Shipbuilding Solutions
- APIs and Developer Solutions

New Words and Phrases:

1. API——Application-Programming Interface	应用程序界面
2. de facto [dei 'fæktəu]	adj. 事实上的，实际的
3. mechanical [mi 'kænik(ə)l]	adj. 机械的，机械制的
4. suite [swi:t]	n.，套房，套，组
5. contain [kən 'tein]	vt. 包含，容纳，容忍
6. technology [tek 'nɔlədʒi]	n. 工艺，科技，技术
7. superior [su: 'piəriə(r), sju:-]	adj. 较高的，出众的
8. industry ['indəstri]	n. 工业，产业，行业
9. wholesale ['həulseil]	adj. 大规模的
10. robust [rəu 'bʌst]	adj. 精力充沛的
11. parametric [ˌpærə 'metrik]	adj. 参变数的，参变量的
12. architecture ['ɑ:kitektʃə(r)]	n. 建筑，体系机构
13. confidence ['kɔnfidəns]	n. 信心

14. certified ['sːtaid]	adj. 被鉴定的
15. interface ['intəfeis]	n. 界面
16. breeze [briːz]	n. 轻而易举的事 vi. 吹微风，逃走
17. associative [ə 'səuʃjətiv]	adj. 联合的，联想的
18. application [æpli 'keiʃ(ə)n]	[计]应用，应用软件
19. responsive [ri 'sponsiv]	adj. 响应的，作出响应的
20. connectivity [ˌkɔnek 'tivəti]	n. 连通性
21. accelerate [ək 'seləreit]	v. 加速，促进
22. development [di 'veləpmənt]	n. 发展
23. innovation [inɔ 'veiʃ(ə)n]	n. 改革，创新
24. overview ['əuvɔvjuː]	n. 一般观察，总的看法
25. functional ['fʌŋkʃən(ə)l]	adj. 功能的
26. foundation [faun 'deiʃ(ə)n]	n. 基础，根本，创立
27. Industrial [in 'dʌstriəl]	adj. 工业的，产业的
28. simulation [simju 'leiʃ(ə)n]	n. 仿真，假装 模拟
29. visualization [ˌvizjuəlai 'zeiʃən, -ʒuə-; -li 'z-]	n. 使看得见的，清楚地呈现在心
30. shipbuilding ['ʃipbildiŋ]	n. 造船

Notes:

1. PTC——Parametric Technology Corporation 参数科技公司（Pro/ENGINEER 是美国 PTC 公司的产品。该公司 1985 年成立于波士顿，它是全球著名的软件公司，同时也是世界最大的 CAD/CAE/CAM 类软件生产公司）

2. Pro/ENGINEER is the industry's de facto standard 3D mechanical design suite.

Pro/ENGINEER 是工业中一流的三维机械设计软件。

3. It contains patent-pending, award-winning technology that helps designers and engineers create superior products more quickly.

它包含正在申请专利的技术和获得广泛赞誉的技术，这些技术都能使设计者和工程师更快地创造出超一流的产品。

4. It is based on Granite One, the industry's most robust, parametric, feature-based architecture - so wholesale design changes can be made with confidence.

它是一种基于工业中最富创造性的全参数化设计和特征建模于一体的应用软件，我们相信这种设计思路的转换会很快被大多数人所接受。

5. Direct Modeling TM and the certified Windows user-interface make learning and using a breeze.

直接的建模式和友好的 Windows 用户操作界面，这些都使学习和应用变得非常容易。

6. Associative Applications 联邦软件

Reading:

Pro/MECHANICA Solutions

To develop good products, design engineers need to study how their designs will behave in real-world conditions. Physical prototyping is an expensive, time-consuming way to do this, and the usual alternative-traditional numerical analysis-depends on highly trained specialists to get accurate results. Fortunately, there's a way to simulate the performance of your designs that doesn't have these drawbacks. Pro/MECHANICA simulates how a product will function in its intended environment-non-specialist design engineers can explore the mechanical performance of design alternatives without building prototypes. With the insight gained from this innovative software, users can improve designs early in the development cycle, when changes are easier and less expensive to make.

Lesson 3 What is "Mechatronics"? (A)

"Mechatronics" is a term coined by the Japanese to describe the integration of mechanical and electronic engineering. The concept may seem to be anything b ut new, since we can all look around us and see a myriad of products that utilize both mechanical and electronic disciplines. Mechatronics, however, specifically refers to a multidisciplined , integrated approach to product and manufacturing system design. It represents the next generation of machines, robots , and smart mechanisms necessary for carrying out work in a variety of environments-primarily, factory automation, office automation, and home automation as shown in Fig. 3.1.

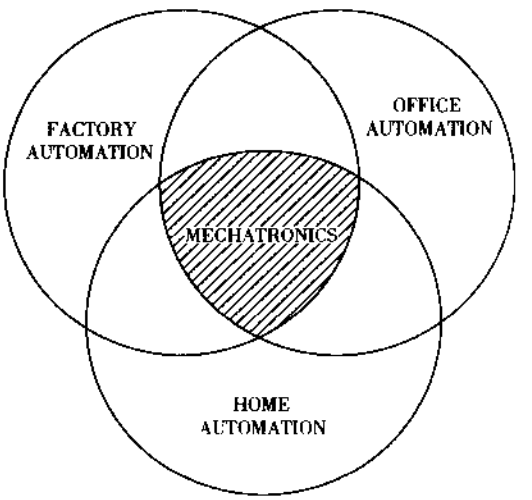

Fig. 3.1

By both implication and application, manufacturing technology and processes, the intent is to force a multidisciplinary approach to these systems as well as to reemphasize the role of process understanding and control. This mechatronic approach is currently speeding up the already-rapid Japanese process for transforming ideas into products.

New Words and Phrases:

1. mechatronic 机械电子学
2. coin [kɔin] vt. 创造
3. integration [ˌinti'greiʃən] n. 综合
4. mechanical [mi'kænik(ə)l] adj. 机械的
5. electronic engineering n. 电子工程学
6. concept ['kɔnsept] n. 观念，概念
7. myriad ['miriəd] n. 无数，无数的人或物 adj. 无数的，种种的
8. utilize [ju:'tilaiz] vt. 利用
9. discipline ['displin] n. 纪律，学科 v. 训练
10. represent [ri:pri'zent] vt. 表现，描绘
11. smart [sma:t] adj. 巧妙的，聪明的，漂亮的，敏捷的
12. multidisciplinary [ˌmʌlti'disiplinəri] adj. 包括多种学科的
13. reemphasize v. 重新强调，再度强调

Notes:

1. mechatronic: 该单词是一个合成词，即由 mechanical 的前半部和 electronic 的后半部分组成。汉语即为机械电子学。本文叙述了该术语的提出和意义。

Reading:

What is "Mechatronics"? (B)

From the very beginnings of recorded time , mechanical systems have found their way into every aspect of our society. Our simplest mechanisms, such as gears, pulleys, springs and wheels, have provided the basis for out tools. Our electronics technology, on the other hand , is completely twentieth-century, all of it created within the past 75 years.

Until now , electronics were included to enhance mechanical systems performance, but the emphasis remained on the mechanical product. There had never been any master plan on how the integration would be done. In the past, it had been done on a case-by-case basis. More recently, however, because of the over-whelming advances in the world of electronics and its capability to physically simplify mechanical configurations, the technical community began to reassess the marriage between these two electronic appendages.

First came the starter motor, and then the generator, each making the original product a bit better than in was before. Then came solid-state electronics, and suddenly the mechanical marvel became an electro-mechanical marvel. Today's machine is controlled by microprocessors, built buy robots, and fault-analyzed by a computer connected to its "external interface connector". Automotive mechanical engineers are no longer the masters of their creations.

The process that describes the evolution of the automobile is somewhat typical of other products in our society. Electronics has repeatedly improved the performance of mechanical systems, but that innovation has been more by serendipity than by design. And that is the essence of mechatronics—the pre-planned application of, and the efficient integration of , mechanical and electronics technology to create optimum product.

Lesson 4 Use of CAD

CAD, normally used in engineering departments, has drastically changed these departments. Drawings used to be made on paper with pencil or pen and drawing instruments.① The drawings were very time intensive to produce. They were then copied, and the copies were sent to the floor for production. The originals were stored in large drawers.② Even a small enterprise could have thousands of large blueprints on file. If changes were necessary, the engineer would get the original out of the file drawer, make the changes, copy it, and send the new print to the floor. The computer eliminated the need for all of the physical storage of prints. The computer also allowed for rapid and easy print modifications.

The engineer or designer first draws the part on the screen. This part drawing is the actual part geometry. The sizes and locations are all correct so that the information can be used later to create a program to machine the part.③

New Words and Phrases:

1. CAD	计算机辅助设计（computer aided design）
2. drastically	adv. 急剧的，强有力的，彻底地
3. instrument ['instrumənt]	n. 仪器，工具，器械，手段
4. floor [flɔ:(r)]	n. 工段，现场，车间
5. original [ə 'ridʒin(ə)l]	n. 原型图，原始图 adj. 最初的，原始的，新颖的
6. blueprint ['blu:print]	n. 设计图，蓝图，方案 vt. 制成蓝图，计划
7. intensive [in 'tensiv]	adj. 强度（大）的，强烈的，精深的，透彻的
8. eliminate [i 'limineit]	v. 除去，剔除，淘汰
9. storage ['stɔ:rdʒ]	n. 储备，贮藏（量），储存
10. modification [mɔdifi 'keiʃ(ə)n]	n. 更改，修改，改进，改进了的形式
11. geometry [dʒi 'ɔmitri]	n. 几何形状，外形尺寸，轮廓
12. location [ləu 'keiʃ(ɔ)n]	n. 位置，地点，定位

Notes:

1. Drawings used to be made on paper with pencil or pen and drawing instruments.

制图过去常常是用铅笔或钢笔以及绘图仪器在纸上完成的。

* used + 带 to 的不定式表示过去惯常性动作。

例如：I used to measure with this instrument. 过去我总是用这个仪器测量。

2. The originals were stored in large drawers.

原始图就被保存在（一些）大的橱柜里。

* The originals：指原始图。

3. The sizes and locations are all correct so that the information can be used later to create a pro-

gram to machine the part.

这些尺寸和位置都是准确的，这样这些信息随后可以被用来编制加工该零件的程序。

* so that 引导一结果状语从句。

* machine：在这儿是动词，意为加工。

Reading:

Application of CAD

Advantages of CAD (Computer Aided Design) for large as well as small merchant manufacturing firms include:

—use and easy modification of previous design permitting easy changes to be processed more quickly;

—design improvements created by features allowing designers to try out a dozen or a hundred different variations where previously they might have been limited to building perhaps three or four prototype models;

—faster construction of drawings: design time with CAD ranges from 5 to 100 times as fast as manual systems, with 2 to 6 times as fast being typical;

CAD buys time. It permits users to try more designs, more options, and more approaches to the optimum product. Where before it took tha bending of metal to see if a concept was viable, now the computer can test concepts in an iterative manner so that the metal-bending now is done only for the best approaches. Since the operations are now simulated the time needed to evaluate many designs is even less than the time to prepare just one engineering model for evaluation. Mistakes are made on the computer display screen where they cost little, instead of in the hardware which, besides being expensive, takes time to create and evaluate. It is not in conceivable that ten to twenty years of product innovation could have been done in CAD facilities in months, with the products of today falling out as the best approaches, given the materials and factories known to exist for these products. The time compression and the subsequent savings, when considered over time, are really astounding.

Lesson 5 Numerical Control①

Numerical control (NC) can be defined as the control of operation of machine tools by a series of coded instructions called the program, which consists mainly of alphanumeric characters (numbers and letters).

We can see from this definition that the sequence of events is both preplanned and predictable. In other words, any desired sequence of events can be obtained by coding the appropriate instructions and can also be changed by changing those coding those coded instructions. Therefore, NC systems are considered to be the typical form of programmable automation.

The basic concept of NC is not new at all and dates back to the early years of the Industrial Revolution, when Joseph Jacquard developed a method to control textile looms by using punched cards. But when he applied for a patent for his invention, he was denied that right by the Queen of England because she believed that it would have put poor workers out of work (notice the similarity with robots nowadays). In fact, this old invention can be considered simple, crude forms of mechanical NC.

New Words and Phrases:

1. Numerical [nju: 'merik(ə)l; (*US*)nu:-] adj. 数字的
2. alphanumeric [ælfənju: 'merik] adj. 包括文字与数字的
3. character ['kæriktə(r)] n. 字符
4. sequence ['si:kwəns] n. 次序，顺序，序列
5. predictable [pri 'diktəb(ə)l] adj. 可预言的
6. textile ['tekstail] n. 纺织品 adj. 纺织的
7. loom [lu:m] n. 织布机，织机
8. *punched card* 穿孔卡片
9. patent ['peit(ə)nt; (*US*) 'pætnt] n. 专利权 adj. 特许的，专利的
10. invention [in 'venʃ(ɔ)n] n. 发明，创造

Notes:

1. Numerical control (NC)：数字控制，本文主要介绍了数字控制的概念、数字控制的起源。

Reading:

Types of Numerical Control Systems

There are three basic types of control systems for NC machine tools, point-to-point, straight cut, and contouring.

Point-to-point system. The point-to-point system is usually used in NC drilling machines that are employed in drilling precise patterns of holes. The function of the NC system is, therefore, to move the spindle (or machine table) to the exact location, as given by a tape command, so that a hole can be drilled. As soon as the desired hole is drilled, the system moves the spindle to the next programmed location to drill another hole, and so on. The spindle (or machine table) movement from one hole location to the next must be done as fast as possible to bring to a minimum the nonproductive time spent in movement. Accordingly, speeds of more than 2500mm/min are quite common.

Straight-cut system. The straight-cut system is quite similar to the previous system, except that the fsed rate of the spindle along each machine axis is controlled so as to be suitable for machining (e. g. , a milling operation on a vertical mill). Again, the spindle cannot be controlled such that it moves along a line inclined to the X and Y axes of the machine, since the motion along each axis is independent from that along the other axis because it is controlled by a separate NC circuit (or subsystem). Nevertheless, motions along lines coinciding with or parallel to either the X or the Y axis can be accurately controlled.

Contouring system. In order to make angular cuts on the workpiece, the two driving servo motors (one for the X-axis motion and the for the Y-axis motion) have to run at unequal speeds. In fact, the rate of travel along the Y direction divided by that along the X direction must be equal to tan , where is the angle that the angular cut makes with the X direction. The capability of a control system to regulate the rate of spindle (or table) travel along two axes of motion the same time is called linear interpolation.

A control system of the contouring type can also produce curves to very close tolerances. Therefore, it is sometimes referred to as the continuous-path system. The method of employing linear interpolation to produce curves involves breaking down a curve or an arc into a large number of straight lines in such a manner that the end of each line is the beginning of the next one (tip-to-tail fashion). Each and every line segment must, therefore, be programmed in order for the path to conform to the desired curve. We can obviously see that the larger the number of segments taken, the smaller each of the segment lines becomes and the smoother the machined curve becomes.