面向"十二五"高等学校精品规划教材·机电类

机电专业英语

别传爽　主编

北京理工大学出版社
BEIJING INSTITUTE OF TECHNOLOGY PRESS

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内 容 提 要

本书由机械工程专业基础知识篇、高新技术篇和前沿知识拓展篇3部分组成。以培养学生阅读和理解机电工程专业英语能力为目标，内容包括机械工程概论、力学、机械设计、液压技术、机械制造、机电一体化技术、数控技术、新能源等。全书共24篇课文，全部课文均有注释、参考译文和作业。

本书可以作为机械设计及自动化、机械电子工程、机电一体化等专业的专业英语教材，也可以供相关专业的人员参考使用。

图书在版编目（CIP）数据

机电专业英语／别传爽主编．—北京：北京理工大学出版社，2010.2
ISBN 978-7-5640-2816-9

Ⅰ．机…　Ⅱ．别…　Ⅲ．机电工程-英语-高等学校-教材　Ⅳ．H31

中国版本图书馆CIP数据核字（2009）第230809号

出版发行／北京理工大学出版社
社　　址／北京市海淀区中关村南大街5号
邮　　编／100081
电　　话／（010）68914775（办公室）　68944990（批销中心）　68911084（读者服务部）
网　　址／http：//www.bitpress.com.cn
经　　销／全国各地新华书店
印　　刷／山东新华印刷厂临沂厂
开　　本／787毫米×1092毫米　1/16
印　　张／14
字　　数／290千字
版　　次／2010年2月第1版　　2010年2月第1次印刷
印　　数／1～2000册
定　　价／28.00元

责任校对／陈玉梅
责任印制／边心超

出版说明

近年来，我国高等教育的改革和发展实现了历史性的跨越，培养了大量人才，为我国经济的发展作出了巨大的贡献，但从IMD国际竞争力指标体系中的分析数据来看，我国企业需要的工程技术人员特别是工程应用型技术人才严重不足，这也热切地呼唤着高等院校培养出更多具备全面的知识、能力和综合素质，面向生产、建设、管理、服务第一线的高级应用型专门人才。教育部在2003年启动了本科教学评估工作，并在2007年提出了本科教育、教学“质量工程”，鼓励和支持高等学校在教学理念等方面进行创新，形成有利于多样化人才成长的培养体系，满足国家对社会紧缺的创新型人才和应用型人才的需要。

北京理工大学出版社组织知名专家、学者，以培养应用型人才为主题进行深入的研讨，规划出版了这套“面向‘十二五’高等学校精品规划教材·机电类”。着力于培养能直接从事实际工作、解决具体问题、维持工作有效运行的高等应用型人才。

本套教材在规划过程中体现了如下基本原则和特点：

■ 学科体系完整，课程间相互衔接紧密。

本套教材根据工程实践需要，按教学体系要求进行整合编排。包括了机电类专业的基础课、专业基础课和部分专业课。除了考虑单门课程自身体系的完整，兼顾不同课程间的衔接。

■ 强调实用性和工程概念。

工程的概念体现在整套教材中，以工程实践要求为核心编写教材。

■ 减少了部分理论推导方面的内容。

强调概念和应用，减少了部分理论推导。在实验环节强调创新型的实验，减少验证型的实验。

■ 结合新技术和新工艺。

充分吸收新技术和新工艺的内容，反映国内外机械学科最新发展。

■ 注重培养学生职业能力。加强学生对 Autocad、UG、Pro/E、Mastercam

等软件进行设计和仿真的能力。

■ 提供教学包，可在北京理工大学出版社网站 www. bitpress. com. cn 下载。

本套教材既严格遵照学科体系的知识构成和教材编写的一般规律，又针对本科人才培养目标及与之相适应的教学特点，精心设计写作体例，科学安排知识内容，表达了一批教育工作者和出版人“精心打造精品，教材服务教育”的理念。

本套教材可作为高等教育应用型本科院校机电类相关专业的课程教学用书，也可以作为机电类技能培训用书。

北京理工大学出版社

前　　言

机电工程专业英语是创新型机械电子工程本科教材编委会推出的机电类系列教材之一。机电工程是一门古老而又前沿的学科，其涉及面非常广泛。内容不仅包括传统的机械设计与制造、力学、材料、机械零件、液压技术、模塑技术，以及先进的机电一体化、数控、机器人、CAD/CAM 技术，还包括最前沿机电产业的太阳能和风能技术。本教材紧随机电工程发展的步伐开展编写，其主要特色有：

1. 以提高学生阅读理解机械工程科技英语文献的能力为目标。教材全部选自欧美原著，行文流畅，内容以基本原理和实际应用为主，去除了比较难以掌握的专业理论知识。每篇课文的难句都有注释，学生易于理解。此外，每篇课文都有一篇内容相近的补充读物，供学生拓展知识，更进一步提高阅读水平。

2. 本书分为 3 部分，即基础知识、高新技术、前沿应用。内容由浅入深、循序渐进，可满足不同专业方向和不同年级的教学要求。

3. 本书在强调基础专业知识的前提下，尤为注重内容的实用性、先进性和前瞻性。通过本书的学习既可以掌握大量的实用专业单词，还可以掌握相关的新技术、新知识。

4. 本教材所有课文都附有参考译文，目的在于方便学生自学。

本书由别传爽担任主编，彭小仙、李硕任副主编。别传爽对本书进行统稿。

中国地质大学孙立鹏教授担任本书主审。

由于时间和水平有限，书中错误之处在所难免，欢迎广大读者批评指正。

编　者

2009 年 11 月

目　录

PART ONE

PART TWO

PART THREE

机电专业英语

PART ONE

Lesson 1

The Evolution of Mechanical Engineering

Section I Text

Mechanical Engineering is an engineering discipline that involves the application of principles of physics and chemistry for analysis, design, manufacturing, and maintenance of various systems. Mechanical Engineering is one of the oldest and broadest engineering disciplines.

It requires a solid understanding of core concepts including mechanics, kinematics, thermodynamics, fluid mechanics, and energy. Mechanical engineers use the core principles as well as other knowledge in the field to design and analyze manufacturing plants, industrial equipment and machinery, heating and cooling systems, motor vehicles, aircraft, watercraft, robots, medical devices and more.

History and Development

Applications of mechanical engineering are found in the records of many ancient and medieval societies throughout the globe. In ancient Greece, the works of Archimedes (287 BC — 212 BC) and Heron of Alexandria (10 — 70 AD) deeply influenced mechanics in the Western tradition. In China, Zhang Heng (78 — 139 AD) improved a water clock and invented a seismometer, and Ma Jun(200 — 265AD) invented a chariot with differential gears.

During the years from the 7th to the 15th century, there were remarkable contributions from Arabians in the field of mechanical technology, Al Jaziri, who was one of them, wrote his famous "Book of Knowledge of Ingenious Mechanical Devices" in 1206 in which he presented many mechanical designs. He is also considered to be the inventor of such mechanical devices that now form the very basics of mechanisms, such as crank and cam shafts. [1]

During the early 19th century in England and Scotland, the development of machine tools led mechanical engineering to develop as a separate field within engineering, providing manufacturing machines and the engines to power them.[2] The first British professional society of mechanical engineers was formed in 1847, thirty years after civil engineers formed the first such professional society. In the United States, the American Society of Mechanical Engineers (ASME) was formed in 1880, becoming the third such professional engineering society, after the American Society of Civil Engineers (1852) and the American Institute of Mining Engineers (1871). The first school in the United States to offer an engineering education was the United States Military Academy in 1817. Education in mechanical engineering has historically been based on a strong foundation in mathematics and science.

The field of mechanical engineering is considered among the broadest of engineering disciplines.[3] The work of mechanical engineering ranges from the depths of the ocean to outer space.[4]

Modern Tools

Many mechanical engineering companies, especially those in industrialized nations, have begun to incorporate computer-aided engineering (CAE) programs into their existing design and analysis processes, including 2D and 3D solid modeling computer-aided design (CAD). This method has many benefits, including easier and more exhaustive visualization of products, the ability to create virtual assemblies of parts, and the ease of use in designing mating interfaces and tolerances. Other CAE programs commonly used by mechanical engineers include product lifecycle management (PLM) tools and analysis tools used to perform complex simulations. Analysis tools may be used to predict product response to expected loads, including fatigue life and manufacturability. These tools include finite element analysis (FEA), computational fluid dynamics (CFD), and computer-aided manufacturing (CAM).

As mechanical engineering begins to merge with other disciplines, as seen in mechatronics, multidisciplinary design optimization (MDO) is being used with other CAE programs to automate and improve the iterative design process. MDO tools wrap around existing CAE processes, allowing product evaluation to continue even after the analyst goes home for the day.[5] They also utilize sophisticated optimization algorithms to more intelligently explore possible designs, often finding better, innovative solutions to difficult multidisciplinary design problems.[6]

Section II New Words and Phrases

discipline	[ˈdisiplin]	*n.*	学科
mechanics	[miˈkæniks]	*n.*	力学
kinematics	[kiniˈmætiks]	*n.*	运动学
thermodynamics	[ˈθəːməudaiˈnæmiks]	*n.*	热力学
fluid mechanics			流体力学
motor vehicles			机动车辆
watercraft			船舶
robot	[ˈrəubɔt]	*n.*	机器人
medieval	[mediˈiːvəl]	*n.*	中世纪
society	[səˈsaiəti]	*n.*	社会,协会
seismometer	[saizˈmɔmitə]	*n.*	地动仪,地震仪
chariot	[ˈtʃæriət]	*n.*	马车
differential	[difəˈrenʃəl]	*adj.*	差分,差动
gear	[giə]	*n.*	齿轮
chariot with differential gears			带差动齿轮的马车
Arabian	[əˈreibjən]	*n.*	阿拉伯人 *adj.* 阿拉伯的
ingenious	[inˈdʒiːnjəs]	*adj.*	精巧的
present	[priˈzent]	*v.*	呈送,提交
crank	[kræŋk]	*n.*	曲轴
cam	[kæm]	*n.*	凸轮
shaft	[ʃɑːft]	*n.*	轴
provide	[prəˈvaid]	*v.*	提供,供给
manufacture	[mænjuˈfæktʃə]	*n.*	制造,制造业 *v.* 制造
professional society			职业协会
civil engineer			土建工程师
exhaustive	[igˈzɔːstiv]	*adj.*	详尽的
visualization	[vizjuəlaiˈzeiʃən]	*n.*	可视化

virtual	[ˈvəːtjuəl]	*adj.*	虚拟的
mating interfaces			配合表面
tolerances		*n.*	公差
fatigue	[fəˈtiːg]	*n.*	疲劳
fatigue life			疲劳寿命
simulation	[simjuˈleiʃən]	*n.*	仿真
response	[riˈspɔns]	*v.*	响应
manufacturability		*n.*	可制造性
product lifecycle management			产品生命周期管理(PLM)
finite	[ˈfainait]	*adj.*	有限的
finite element analysis (FEA)			有限元
computer-aided manufacturing(CAM)			计算机辅助制造
merge	[məːdʒ]	*v.*	合并
mechatronics	[mekəˈtrɔniks]	*n.*	机电一体化,机械电子
multidisciplinary	[mʌltiˈdisiplinəri]	*adj.*	多学科的
optimization	[ɔptimaiˈzeiʃən]	*n.*	优化
multidisciplinary design optimization (MDO)			跨学科设计优化
computational fluid dynamics (CFD)			计算流体动力学
iterative	[ˈitərətiv]	*adj.*	迭代的
evaluation	[ivæljuˈeiʃən]	*n.*	评估
sophisticated	[səˈfistikeitid]	*adj.*	复杂的
wrap	[ræp]	*v.*	捆绑,结合 wrap around 环绕
algorithm	[ˈælgəriðəm]	*n.*	算法
innovative	[ˈinəuveitiv]	*adj.*	革新的
intelligent	[inˈtelidʒənt]	*adj.*	聪明的

Section III Notes to Complex Sentences

[1] He is also considered to be the inventor of such mechanical devices that now form the very basic of mechanisms, such as crank and cam shafts.

他还被认为是很多机械的发明者，这些机械演变成当今最基本的机构，如曲轴和凸轮轴。that now form the very basic of... 是定语从句，修饰 devices.

[2] ... the development of machine tools led mechanical engineering to develop as a separate field within engineering, providing manufacturing machines and the engines to power them.

……机器工具的发展导致机械工程从其他工程领域分离出来，专门提供机器和发动机制造。

led... to：导致……。providing ... 引导的分词短语 manufacturing machines and engines 为 providing 的宾语，to power them 修饰 engines，them 指 machines.

[3] The field of mechanical engineering is considered among the broadest of engineering disciplines.

机械工程被认为是范围最广的学科之一。field：学科，领域；is considered among：相当于 is considered one of the...。

[4] The work of mechanical engineering ranges from the depths of the ocean to outer space.

机械工程所涉及的领域遍及深海至外层空间。

range from... to：（范围）从……到，遍及。depth of the ocean：深海。

[5] MDO tools wrap around existing CAE processes, allowing product evaluation to continue even after the analyst goes home for the day.

MDO 工具结合已有的 CAE 程序，能够让产品评估过程不间断进行，即使分析员下班回家。

wrap around：原意是将多个物品绑在一起，这里指一个进程与其他进程合并运行。

[6] They also utilize sophisticated optimization algorithms to more intelligently explore possible designs ...

它们还应用复杂的优化算法来寻求可能的设计方案……

They：指 MDO tools；to more intelligently explore：to explore more intelligently，根据汉语习惯，more intelligently 可以转译或省略。

Section IV Exercises

1. Translate the following paragraph into Chinese.

What Is a Mechanical Engineer?

Mechanical engineering plays a dominant role in enhancing safety, enjoyment and overall quality of life throughout the world. Mechanical engineers are concerned with the principles of force, energy and motion. Mechanical engineers are professionals with expert knowledge of the design and manufacture of mechanical systems and thermal devices and processes. Some examples of products and processes developed by mechanical engineers include engines and control systems for automobiles and aircraft, electric power generation plants, lifesaving medical devices and consumer products ranging from air conditioners to personal computers and athletic equipment. They also design the machines that mass-produce these products. Virtually every aspect of life is touched by mechanical engineering.

2. Find the meaning of the following words or abbreviations from the text.

ASME, CAE, CAD, CAM, FEA, MDO

Section V Supplementary Reading

Nonverbal Thinking in Engineering

Many objects in daily use have clearly been influenced by science. However, their form and function, their dimensions and appearance, were determined by technologists, designers, inventor, and engineers using nonscientific modes of thought. Many features and qualities of the objects that a technologist thinks about can not be reduced to unambiguous verbal descriptions; they are dealt with in the mind by a visual, nonverbal process. Pyramids, cathedrals, and rockets exist not because of geometry or thermo-dynamics, but because they were first the picture in the minds of those who built them.

The creative shaping process of a technologist's mind can be seen in nearly every artifact that exists. For example, in designing a diesel engine, a technologist might express individual ways of nonverbal thinking on the machine by continually using an intuitive sense of rightness and fitness. What would be the shape of the combustion chamber? Where should the valves be placed? Would it have a long or short piston? Such questions have a range of answers that are supplied by experience, by physical requirement, by limitations of available space, and not in the least by a sense of form. Some decisions, such as wall thickness, and pin diameter, may depend on scientific calculations, but the nonscientific component design remains primary.

Design courses, then, should be an essential element of engineering curricula. Nonverbal-thinking, a central mechanism in engineering design, involves perceptions, which is the special technique of the artists, not the scientists. Because perceptive processes are not assumed to need "hard thinking," nonverbal thought is sometimes seen as a primitive stage in the development of cognitive processes and inferior to verbal mathematical thought.

If courses in design, which in a strongly analytical engineering curriculum provide the background required for practical problem-solving, are not provided, we can expect to encounter silly but costly errors occurring in advanced engineering systems. For example, early modes of high-speed railroad cars loaded with sophisticated controls were unable to operate in a snowstorm because the fan sucked snow into the electrical system. Absurd random failures that plague automatic control systems are a reflection of the chaos that results when design is assumed to be primarily a problem in mathematics.

Fundamentals of Machine Design

Section I Text

Design is essentially a decision-making process. If we have a problem, we need to design a solution. In other words, to design is to formulate a plan to satisfy a particular need and to create something with a physical reality. A bad decision leads to a bad design and a bad product.

There are many factors to be considered while attacking a design problem. In many cases this is a common sense approach to solving a problem. [1] Some of these factors are as follows.

- What device or mechanism to be used — This is best judged by understanding the problem thoroughly. Sometimes a particular function can be achieved by a number of means or by using different mechanisms and the designer has to decide which one is the most effective under the circumstances.
- Material — This is a very important aspect of any design. A wrong choice of material may lead to failure, over or undersized product or expensive items. [2] The choice of materials is thus dependent on suitable properties of the material for each component, their suitability of fabrication or manufacture and the cost.
- Load — The external loads cause internal stresses in the elements and these stresses must be determined accurately since these will be used in determining the component size.
- Size, shape, space requirements and weight — Preliminary analysis would give an approximate size. But if a standard element is to be chosen, the next larger size must be taken. [3] Shapes of standard elements are known but for non-standard element, shapes and space requirements must depend on available space in a particular machine assembly. A scale layout drawing is often useful to arrive at an initial shape and size. [4] Weight is important depending on