Specialized English for Mechanical Engineering and Automation

机械工程及自动化专业英语

主　编　郭少华　苏翊翔
副主编　王雅慧

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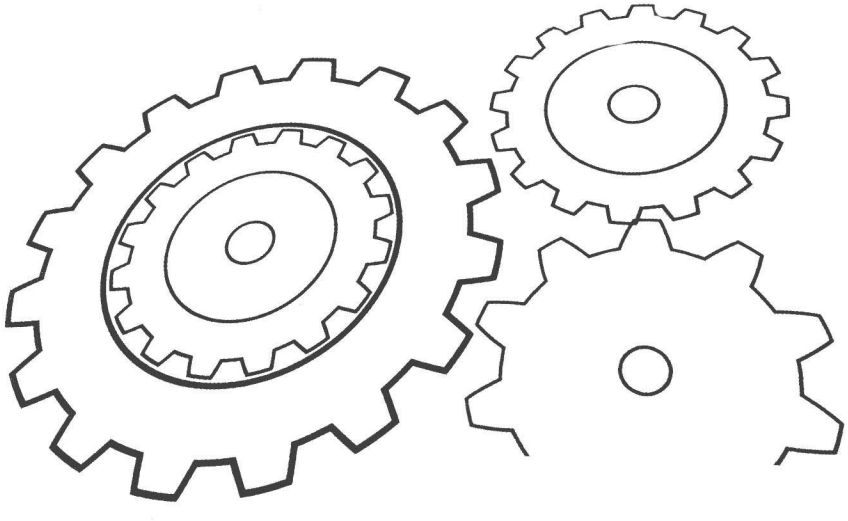

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内 容 提 要

专业英语的学习需要紧密联系日新月异的技术、发明和设计理念。本书内容不仅包括机械工程和自动化的基础知识，还精选了多篇介绍新发明和新技术的文章作为补充阅读材料，充分与时代接轨。每个单元包括课文、练习、课外阅读、科技英语翻译技巧和训练四部分。练习中的朗读部分侧重培养学生对句子重读、断句和连读的把握，彻底摆脱“哑巴”专业英语的尴尬；而翻译技巧部分则结合例句言简意赅地讲解了科技英语的翻译技巧，培养学生的科技文体意识。本书最后还附有全书的词汇总表，方便学习者在学习过程中查阅、复习和巩固。

本书每个单元的朗读练习部分都配有美籍专家的录音，学习者可以登陆中国水利水电出版社网站 http://www.waterpub.com.cn/Softdown/免费下载。

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前　言

本书可作为机械工程与自动化和机械制造与自动化专业本科高年级学生的专业英语教材，也可作为有志于从事科技英语翻译的英语专业学生的教材。

全书共16个单元，内容涉及机械工程概况、工程材料、机械构件、加工设备、机械自动化等基础知识，以及科学管理和质量控制的基本概念。每单元主要包括课文、练习、课外阅读、科技英语翻译技巧和训练四个部分。

Text部分旨在培养学生阅读和翻译科技英语文献的能力。每篇文章有700~1000个单词，长度和语言难度适中，内容突出知识性、可读性、实用性。课文配有生词表和注释。生词表部分注有音标、词性和词义；注释部分对难词、难句、语法难点进行详细讲解。

Exercises部分旨在培养学生的语言运用能力，由讨论题、翻译和朗读三种类型的练习构成。讨论题旨在鼓励学生开口说英语，摆脱“哑巴”英语的学习误区。翻译有三种形式：短语英汉互译、句子英译汉和短文英译汉。短语翻译旨在加强Text部分常用短语和固定搭配的学习和积累。句子的翻译旨在提高学生对疑难句子语法结构的分析能力和翻译能力。短文翻译的选文与Text部分的主题密切相关，旨在培养类似语篇的阅读和翻译能力。朗读部分由两项练习组成，旨在培养学生正确发音和朗读的习惯。第一项旨在训练词重音，即两个音节以上单词的重读音节。第二项旨在训练句子的朗读能力，主要有断句、句子重音以及连读。“断句”就是学会划分意群，在正确的地方断句；“句子重音”就是能够识别句子中哪些词要重读，哪些词要弱读，读出节奏，读出韵律；“连读”就是平时朗读时应养成连读的习惯，才能逐渐适应英语为本族语者正常语速的连贯讲话方式。朗读部分配有录音，方便学习者跟读模仿。

Reading for inspirations部分旨在通过阅读来激发未来机械工程师的创造灵感。文章从讨论卓越工程师的必备素质，如何保护、推广发明成果，到介绍每一项富有创意、激动人心的新发明，充分展示了未来机械工程师将踏入的充满创意的崭新世界。

翻译技巧部分用言简意赅的文字对科技英语翻译技巧逐一讲解，配合例子

加以说明。这部分旨在培养学生的科技文体意识，比较英汉表达习惯的差别，真正领会科技英语的精髓。文后配有针对性强的翻译训练，旨在巩固每单元所学的翻译技巧。

本书最后还附有全书的词汇总表，方便学习者在学习过程中查阅、复习和巩固。

编写分工如下：郭少华负责全书科技翻译技巧和练习的编写以及 5～14 单元文章、注释和练习的编写及词汇总表的汇编。苏翊翔负责 1～4 单元、15～16 单元全套内容的编写，以及 5～14 单元朗读部分的编写。王雅慧负责 5～14 单元的课文词汇表和补充读物的编写，并参与了所有翻译练习的校审。

本书在编写过程中，还得到多位同事和朋友的支持和帮助，这里向吴典明、吴梅香、陈斌峰、初勇、初蕾、苏晓辉、付伟和陈芝表示感谢。

受编者水平所限，本书恐难免谬误，敬请读者批评指正。

编者

2012 年 5 月

Contents

Unit 1 An Overview of Mechanical Engineering

Text

Mechanical engineering is concerned with the design, manufacture, installation, and operation of engines and machines and with manufacturing processes. It requires a solid understanding of concepts including mechanics, thermodynamics, and engineering design; as well as solid grounding in physics and math. Mechanical engineers use these core principles along with tools like computer-aided engineering and product lifecycle management to design and analyze manufacturing plants, industrial equipment and machinery, heating and cooling systems, transport systems, aircraft, watercraft, robotics, medical devices and more.

History of mechanical engineering

History of mechanical engineering dates to ancient Greece and China, where mechanisms like screw pumps, steam engines, clocks, seismometers, and even differential gears were invented. Chain drives, crankshafts, and camshafts date to the Middle Ages. As a field of engineering study, however, mechanical engineering did not start until the advent of the Industrial Revolution with the demand for the steam engine. The invention of the steam engine in the latter part of the 18th century gave an enormous impetus to the development of machinery of all types. As a result, a new major classification of engineering dealing with tools and machines developed, receiving formal recognition in 1847 in the founding of the Institution of Mechanical Engineers in the United Kingdom. Mechanical engineering has evolved from the practice by the mechanic of an art based largely on trial and error to the application by the professional engineer of the scientific method in research, design, and production. Since then, advancements in the field of mechanical engineering have led to such breakthroughs as the internal combustion engine, which made heavier-than-air powered flight possible and would also lead to the development of the automoblie, air conditioning, robotics, and more.

Mechanical engineering subdisciplines

Mechanical engineering is a collection of many mechanical engineering subdisciplines. Fundamental subjects of mechanical engineering include:

Mechanics

Mechanics is the physical science that deals with the state of rest or motion of bodies under forces. It includes specific topics such as statics and dynamics, strength of materials, solid mechanics, fluid mechanics/fluid dynamics, hydraulics and pneumatics, and mechanism design

(which includes kinematics).

Mechanics is used extensively in the design and analysis phases of a project. In vehicle design, statics will be employed in the design of the frame of the vehicle, in order to evaluate where and how the stresses will interact. Dynamics might be used when designing the car's engine, to evaluate the forces on the pistons and cams as the engine cycles. Mechanics of materials will be used to choose appropriate materials for each component of the frame and engine. Fluid mechanics will be used to design a ventilation system for the vehicle, and intake system of the engine.

Structural analysis

Structural analysis is devoted to examining why and how parts fail. Structural failures occur in two general modes: static failure and fatigue failure. *Static structural failure* occurs when, upon being loaded (having a force applied), the object being analyzed either breaks or is deformed plastically, depending on the criterion for failure. *Fatigue failure* occurs when an object fails after a number of repeated loading and unloading cycles. Fatigue failure occurs because of imperfections in the object.

Structural analysis is often used by mechanical engineers after a failure has occurred, or when designing to prevent failure. It may be used in the office when designing parts, in the field to analyze failed parts, or in laboratories where parts might undergo controlled failure tests.

Thermodynamics

Thermodynamics covers topics such as heat transfer, energy conversion, and refrigeration/air conditioning. It is the study of the relationship between heat, work, temperature, and energy. In broad terms, thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work.

Drafting

Drafting or technical drawing is the means by which mechanical engineers create instructions for manufacturing parts. A technical drawing can be a computer model or hand-drawn schematic showing all the dimensions necessary to manufacture a part, as well as assembly notes, a list of required materials, and other pertinent information. A U.S. mechanical engineer or skilled worker who creates technical drawings may be referred to as a drafter or draftsman. Drafting has historically been a two-dimensional process, but recent Computer-Aided Designing (CAD) programs have begun to allow the designer to create a part in three dimensions.

New Words and Expressions

manufacture [ˌmænju'fæktʃə] *vt. & n.* 制造

installation [ˌinstə'leiʃən] *n.* 安装，设置；装置，设备

operation [ˌɔpə'reiʃən] *n.* 操作，运转，经营

thermodynamics [ˌθə:məudai'næmiks] *n.* 热力学
core [kɔ:] *n.* 核心，精髓，要点；果核
principle ['prinsəpl] *n.* 原理，原则
machinery [mə'ʃi:nəri] *n.*（总称）机器
watercraft [wɔ:təkrɑ:ft] *n.* 船只
robotics [rəu'bɔtiks] *n.* 机器人技术
device [di'vais] *n.* 装置，设备，器具
mechanism ['mekənizəm] *n.* 机械装置
seismometer [saiz'mɔmitə] *n.* 地震检波器
differential [ˌdifə'renʃəl] *adj.* 差动
gear [giə] *n.* 齿轮；传动装置；（排）挡；用具，设备
crankshaft ['kræŋkʃɑ:ft] *n.* 机轴，曲轴
camshaft ['kæmʃɑ:ft] *n.* 凸轮轴
advent ['ædvənt] *n.* 出现，到来
classification [klæsifi'keiʃən] *n.* 分类，分级；类别，种类，门类
evolve [i'vɔlv] *vt. & vi.* 演变；进化
trial ['traiəl] *n.* 测试，试验，考验；审判，审理
application [æpli'keiʃən] *n.* 应用；申请
combustion [kəm'bʌstʃən] *n.* 燃烧
subdiscipline ['sʌb'disiplin] *n.* （学科的）分支，分科
motion ['məuʃən] *n.*（物体的）运动
statics ['stætiks] *n.* 静力学
dynamics [dai'næmiks] *n.* 动力学，力学
fluid ['flu:id] *adj.* 流体的，流动的　　*n.* 液体，流体
hydraulics [hai'drɔ:liks] *n.* 水力学
pneumatics [nju:'mætiks] *n.* 气体力学
kinematics [kini'mætiks] *n.* 运动学（力学的一个分支，研究物体的运动）
vehicle ['vi:ikl] *n.* 交通工具，车辆
frame [freim] *n.* 框架，骨架，构架
evaluate [i'væljueit] *vt.* 估算；评价，估价
piston ['pistən] *n.* 活塞
cam [kæm] *n.* 凸轮
component [kəm'pəunənt] *n.* 成分，组成部分，部件，元件
ventilation [ventə'leiʃən] *n.* 空气流通；通风设备；通风方法
analysis [ə'næləsis] *n.* 分析
part [pɑ:t] *n.* 零部件
criterion [krai'tiəriən] *n.*（批评、判断等的）标准，准则
conversion [kən'və:ʃən] *n.* 变换，转化

term [tə:m] *n.* 术语，专门用语
dimension [di'menʃən] *n.* 尺寸，度量；方面，部分
schematic [ski:'mætik] *n.* 图表　*adj.* 图表的；概略的
pertinent ['pə:tinənt] *adj.* 有关的；相关的

Notes

1．mechanical [mi'kænikəl] *adj.* 机械的，力学的
mechanics [mi'kæniks] *n.* 力学；机械学
mechanic [mi'kænik] *n.* 技工，机修工

2．be concerned with 意为“牵涉到，与……有关”。例如：These researches are concerned with gravity. 这些研究与引力有关。

3．drive [draiv] *n.* 传动，驱动。例如：This car has a front-wheel drive. 这辆汽车使用前轮驱动。

4．impetus ['impitəs] *n.* 推动，促进，刺激；推动力。例如：The treaty gave a fresh impetus to trade. 这项条约使双方的贸易又推进了一步。This is the primary impetus behind the economic recovery. 这是促使经济复苏的主要动力。

5．Institution of Mechanical Engineers 简称 IMecE，英国机械工程师协会。该协会成立于 1847 年，是世界上最早的机械工程学术团体。它的成立标志着机械工程已成为一个独立的学科，机械工程师也被社会公认为受尊敬的职称。它也是英国法定的机械工程师资格鉴定机构。

6．fatigue [fə'ti:g] *n.* 疲劳，劳累。例如：fatigue failure 疲劳断裂；疲劳损坏。

7．corresponding to 意为“相当于……，与……相一致”。例如：What we required you to do is corresponding to the contract. 我方要求贵方所做事宜符合合同规定。

8．be referred to as 意为“被称为……”。例如：Smoking is usually referred to as a bad habit. 吸烟通常被认为是坏习惯。

Exercises

Ⅰ．Questions for discussion.

1．What does mechanical engineering study?
2．What are the major subdisciplines of mechanical engineering?
3．Are you interested in mechanical engineering? Why/Why not?
4．Which inventor in the world history do you admire most?
5．Which invention in the 20th century do you think is the greatest?
6．To be an inventor, what qualities are essential?

Ⅱ．Put the following expressions into Chinese.

manufacturing process
screw pump
differential gear

chain drive
trial and error
state of rest
motion of bodies under forces
solid mechanics
fluid dynamics
strength of materials
intake system
heat transfer
deformed plastically
in three dimensions

Ⅲ. Put the following expressions into English:

机械工程
工程设计
在物理学方面有坚实的基础知识
产品生命周期
制造厂/生产厂
工业设备
供暖和冷却系统
蒸汽机
工业革命
内燃机
通风系统
结构分析
装卸
能量传递
制图
所需的材料
相关的信息
技术工人
汽车设计

Ⅳ. Put the following sentences into Chinese.

1. Mechanical engineering is concerned with the design, manufacture, installation, and operation of engines and machines and with manufacturing processes.

2. Mechanical engineers use these core principles along with tools like computer-aided engineering and product lifecycle management to design and analyze manufacturing plants, industrial equipment and machinery, heating and cooling systems, transport systems, aircraft,

watercraft, robotics, medical devices and more.

3. Mechanical engineering has evolved from the practice by the mechanic of an art based largely on trial and error to the application by the professional engineer of the scientific method in research, design, and production.

4. Dynamics might be used when designing the car's engine, to evaluate the forces on the pistons and cams as the engine cycles.

5. A technical drawing can be a computer model or hand-drawn schematic showing all the dimensions necessary to manufacture a part, as well as assembly notes, a list of required materials, and other pertinent information.

Ⅴ. Put the following passage into Chinese.

As we look around us we see a world full of "things": machines, devices, tools; things that we have designed, built, and used; things made of wood, metals, ceramics, and plastics. We know from experience that some things are better than others; they last longer, cost less, look better, or are easier to use.

Ideally, however, every such item has been designed according to some set of "functional requirements" as perceived by the designers — that is, it has been designed so as to answer the question, "Exactly what function should it perform?" In the world of engineering, the major function frequently is to support some type of loading due to weight, inertia(惯性), pressure, etc. From the beams in our homes to the wings of an airplane, there must be an appropriate melding of materials, dimensions, and fastenings to produce structures that will perform their functions reliably for a reasonable cost over a reasonable lifetime.

Ⅵ. Read the following passages aloud.

语音小常识

规则的名词复数、动词第三人称单数加"s"或"es"的发音规则

- "s"在清辅音后，读[s]，如 books 中 k 发清辅音[k]，所以 s 发[s]。
- "s"在浊辅音和元音后读[z]，如 digs 中 g 发浊辅音[g]，所以 s 发[z] ，plays 中 ay 发元音[ei]，所以 s 发[z]。
- "s"接在 t，d 之后时，应与前面的[t]，[d]连起来一起读，如 gets 就是[gets]，feeds 就是[fi:dz]。
- "es"在 ch，sh，s，x，o 等后读[iz]，如 watches 就是[wɔtʃiz]，kisses 就是[kisiz]。

Now you try!

- "s"在清辅音后：topics ['tɔpiks]
- "s"在浊辅音后：engines ['endʒinz]；machines [mə'ʃi:nz]；principles ['prinsəplz]；tool [tu:lz] systems ['sistəmz]；materials [mə'tiəriəlz]；includes [in'klu:dz]
- "s"在元音后：requires [ri'kwaiəz]；engineers [endʒi'niəz]

- “s”接在t，d后：concepts ['kɔnsepts]；plants [plɑ:nts]
- “es”在ch，sh，s，x，o等后：processes ['prəusesiz]；devices [di'vaisiz]；forces [fɔ:siz]

1．Read after the recording and pay special attention to the **“stressed syllabuses”** which have been underlined for you.

Mechanical engineering is concerned with the design, manufacture, installation, and operation of engines and machines and with manufacturing processes. It requires a solid understanding of concepts including mechanics, thermodynamics, and engineering design; as well as solid grounding in physics and math. Mechanical engineers use these core principles along with tools like computer-aided engineering and product lifecycle management to design and analyze manufacturing plants, industrial equipment and machinery, heating and cooling system, transport systems, aircraft, watercraft, robotics, medical devices and more.

Mechanics is the physical science that deals with the state of rest or motion of bodies under forces. It includes specific topics such as statics and dynamics, strength of materials, solid mechanics, fluid mechanics/fruid dynamics, hydraulics and pneumatics, and mechanism design (which includes kinematics).

朗读技巧

- 朗读英文句子时，意群之间要有一个短的停顿，句子之间要有一个稍长的停顿。
- 词与词之间，如果前一个词以辅音结尾，后一个词以元音开头，这两个词通常连读（liaison）。平时养成连读的习惯有助于听懂英语为母语人士正常语速的口语表达。

2．Read after the recording and pay special attention to **“sense groups”** and **“liaison”**. The underlined are the parts that can be linked together.

Mechanical engineering is concerned with / the design, manufacture, installation, / and operation of engines and machines / and with manufacturing processes. // It requires a solid understanding of concepts / including mechanics, thermodynamics, and engineering design; / as well as solid grounding in physics and math. // Mechanical engineers use these core principles along with tools like / computer-aided engineering and product lifecycle management / to design and analyze manufacturing plants, industrial equipment and machinery, / heating and cooling systems, transport systems, / aircraft, watercraft, robotics, medical devices and more.

Mechanics is the physical science that deals with / the state of rest or motion of bodies under forces. // It includes specific topics such as / statics and dynamics, strength of materials, solid mechanics, / fluid mechanics, hydraulics and pneumatics, / and mechanism design (which includes kinematics).

Reading for inspirations

Top 10 Qualities of a Great Engineer

There are certain personality traits which are key to a successful engineer. If applying for

mechanical engineer jobs, then possessing most or all of these traits will put you ahead of other applicants applying for mechanical engineer vacancies.

It will also put you on the best track for a long and accomplished career in engineering. This may be in any industry sector such as the aerospace industry, manufacturing industry, automobile industry or other. Some key traits include:

1. Being logical

All engineers have logical thinking skills. This allows them to look at any problem and break it down into smaller problems. This logical approach allows the engineer or engineering team to make sense of complex systems, understand how things work and how problems arise and to find the best and most appropriate solution.

2. Being a bit of a perfectionist

Engineers will always strive for perfection and better ways of doing things. This might be in the presentation of their work or the solution itself. Striving for excellence is a key engineering trait. A great engineer pays meticulous attention to details. The slightest error can cause an entire structure to fail, so every detail must be reviewed thoroughly during the course of completing a project.

3. Being organised

An organised engineer is often a sign of someone who likes order and structure. This is important as it allows the engineer to get work completed more efficiently. You never find a messy engineer!

4. Liking science

Engineers should enjoy elements of science, because this allows them to find out how things work which is something an engineer loves to discover. A love for science is usually a sign of a potential engineer.

5. Loving to talk

Whatever field of engineering they are a part of, engineers love to talk about their topic. They therefore love debating issues within the field and embracing their topic with open arms. If there is a conflict, they love to talk about it until it is solved and will not rest until some conclusion has been made. This shows the passion of an engineer.

6. Being concentrated

Engineers are able to concentrate on something intently for a long amount of time, whether this is an electronics engineer concentrating on working on a cable or an automobile engineer focusing on analysing a component of the car's engine. This level of concentration allows them to fully comprehend the project and come up with solutions.

7. Being creative

Creativity is important for an engineer as they often have to think outside of the box in order to solve problems which may be somewhat baffling to overcome. A great engineer is creative and can think of new and innovative ways to develop new systems and make existing things work

more efficiently.

8. Having good problem solving skills

A great engineer has sharp problem solving skills. An engineer is frequently called upon solely to address problems, and they must be able to figure out where the problem stems from and quickly develop a solution.

9. Having great communication skills

They can translate complex technical lingo into plain English and also communicate verbally with clients and other engineers working together on a project.

10. Taking part in continuing education

A great engineer stays on top of developments in the industry. Changes in technology happen rapidly, and the most successful engineers keep abreast of new research and ideas.

New Words and Expressions

trait [treit] *n.* 人的个性，显著的特点，特征
applicant ['æplikənt] *n.* 申请人，求职人
vacancy ['veikənsi:] *n.* 空缺，空职，空额
accomplished [ə'kɔmpliʃt] *adj.* 完成了的；实现了的；竣工的
aerospace industry 航空和航天工业
logical thinking 逻辑思维
break down 拆散；分类；分解
approach [ə'prəutʃ] *n.* 方式，方法
make sense of 搞清……的意思
perfectionist [pə'fekʃənist] *n.* 完美主义者
strive for perfection/excellence 追求完美/卓越
meticulous [mi'tikjuləs] *adj.* 极仔细的；一丝不苟的
potential [pə'tenʃəl] *adj.* 潜在的，有可能的
embrace [im'breis] *vt. & vi.* 拥抱
with open arms 热情，衷心地
analyse ['ænəlaiz] *vt.* 分析，分解，解释
come up with 想出，提出
think outside of the box 创造性地思考问题，跳出思维的定式
baffling ['bæfliŋ] *adj.* 令人困惑的，难对付的；难解的
innovative ['inəuveitiv] *adj.* 新发明的，新引进的；革新的；有改革精神的
problem solving skills 解决问题的技能
address problems 解决问题；谈及问题
stem from 来自，起源于；由……造成
lingo ['liŋgəu] *n.* 听不懂的话（指方言、术语等）；隐语；外语
communicate verbally 言语交流，口头交流