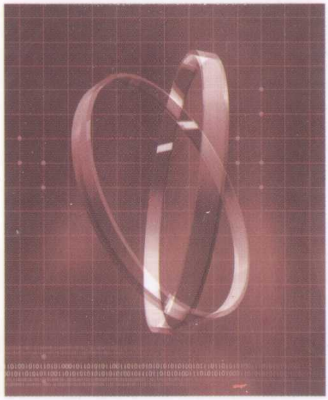
高等学校“十二五”规划教材



土木工程专业英语

主编　贾艳敏

English for Civil Engineering

哈爾濱工業大學出版社
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（第5版）

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内 容 提 要

本书以培养学生用英语作为工具交流专业信息的能力为主要目标，内容包括：力学，建筑材料，结构设计，混凝土结构，高层建筑，基础工程，道路与桥梁，计算机应用，工程管理，工程招标，科技写作等方面的文章。全书共有60篇课文，其中32篇课文有参考译文。

本书可以作为工业与民用建筑，建筑工程管理，道路与桥梁等专业学生的专业英语教材或课外阅读材料，也可以供从事土木工程专业的技术人员和管理人员自学使用。

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前　言

专业英语是大学英语教学的一个重要组成部分，是促进学生们完成从英语学习过渡到实际应用的有效途径。教育部颁布的“大学英语教学大纲”中明确规定专业英语为必修课程，要求通过四年不断线的英语学习，培养学生以英语为工具交流信息的能力。作者们根据此精神编写了这本《土木工程专业英语》教材，以满足高等院校工业与民用建筑，建筑工程管理，道路与桥梁工程及其他有关专业学生们专业英语教学的需求和从事上述各专业的工程技术人员学习英语的要求。

本书所涉及的内容包括：力学、建筑材料、结构设计、混凝土结构、高层建筑、基础工程、道路与桥梁、计算机应用、工程管理、工程招标、科技写作等方面。通过这本教材，学生们不仅可以熟悉和掌握土木工程常用的英语单词、词组及其用法，而且可以深化专业知识，从而为今后的学习和工作打下良好的基础。

在此次再版前，编者们吸取了多所大学在使用本书过程中提出的许多宝贵意见，对本书进行了全面地修订、改写和补充。本书由 60 篇课文组成，其中 32 篇课文附有参考译文。本书选材广泛，内容丰富，语言规范，难度适中。

本书由贾艳敏主编，参加编写工作的有马云峰，施晓菲，郭启臣，林晓东，赵颖。本书由施平主审。

由于水平有限，书中难免有不足和欠妥之处，恳请广大读者批评指正。

编　者

2013 年 12 月

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参考译文

1 Introduction to Mechanics of Materials

In all engineering construction the component parts of a structure must be assigned definite physical sizes. Such parts must be properly proportioned to resist the actual or probable forces that may be imposed upon them. Thus, the walls of a pressure vessel must be of adequate strength to withstand the internal pressure; the floors of a building must be sufficiently strong for their intended purpose; the shaft of a machine must be of adequate size to carry the required torque; a wing of an airplane must safely withstand the aerodynamic loads which may come upon it in flight or landing. Likewise, the parts of a composite structure must be rigid enough so as not to deflect or "sag" excessively when in operation under the imposed loads. A floor of a building may be strong enough but yet may deflect excessively, which in some instances may cause misalignment of manufacturing equipment, or in other cases result in the cracking of a plaster ceiling attached underneath. Also a member may be so thin or slender that, upon being subjected to compressive loading, it will collapse through buckling; i. e., the initial configuration of a member may become unstable. Ability to determine the maximum load that a slender column can carry before buckling occurs or determination of the safe level of vacuum that can be maintained by a vessel is of great practical importance.

Mechanics of materials is a fairly old subject, generally dated from the work of Galileo in the early part of the seventeenth century. Prior to his investigations into the behavior of solid bodies under loads, constructors followed precedents and empirical rules. Galileo was the first to attempt to explain the behavior of some of the members under load on a rational basis. He studied members in tension and compression, and notably beams used in the construction of hulls of ships for the Italian navy. Of course much progress has been made since that time, but it must be noted in passing that much is owed in the development of this subject to the French investigators, among whom a group of outstanding men such as Coulomb, Poisson, Navier, St. Venant, and Cauchy, who worked at the break of the nineteenth century, has left an indelible impression on this subject.

The subject of mechanics of materials cuts broadly across all branches of the engineering profession with remarkably many applications. Its methods are needed by civil engineers in the design of bridges and buildings; by mining engineers and architectural engineers, each of whom is interested in structures; by mechanical and chemical engineers, who rely upon the methods of this subject for the design of machinery and pressure vessels; by metallurgists, who need the fundamental concepts of this subject in order to understand how to improve existing materials further; finally, by electrical engineers, who need the methods of this subject because of the importance of the mechanical engineering phases of many portion of electrical equipment. Mechanics of materials has characteristic methods all its own. It is a definite discipline and one of the most fundamental subjects of an engineering curriculum, standing alongside such other basic subjects as fluid mechanics, thermodynamics, and basic electricity.

The behavior of a member subjected to forces depends not only on the fundamental laws of Newtonian mechanics that govern the equilibrium of the forces but also on the physical characteristics of the materials of which the member is fabricated. The necessary information regarding the latter comes from the laboratory where materials are subjected to the action of accurately known forces and the behavior of test specimens is observed with particular regard to such phenomena as the occurrence of breaks, deformations, etc. Determination of such phenomena is a vital part of the subject, but this branch of the subject is left to other books. Here the end results of such investigations are of interest, and this course is concerned with the analytical or mathematical part of the subject in contradistinction to experimentation. For the above reasons, it is seen that mechanics of materials is a blended science of experiment and Newtonian postulates of analytical mechanics. From the latter is borrowed the branch of the science called statics, a subject with which the reader of this book is presumed to be familiar, and on which the subject of this book primarily depends.

The subject matter can be mastered best by solving numerous problems. The number of formulas necessary for the analysis and design of structural and machine members by the methods of mechanics of materials is remarkably small; however, throughout this study the student must develop an ability to visualize a problem and the nature of the quantities being computed. Complete, carefully drawn diagrammatic sketches of problems to be solved will pay large dividends in a quicker and more complete mastery of this subject.

Words and Expressions

component part 构件,组成部分

torque [tɔ:k] *n.* 转动力矩,扭矩;*v.* 扭转

impose [im'pəuz] *v.* 将…强加于,施加,强使

composite ['kɔmpəzit] *a.* 合成的,复合的;*n.* 复合材料,合成物

sag [sæg] *n.* ;*v.* 下垂,凹陷

deflect [di'flekt] *v.* 偏转,弯曲,下垂,倾斜

excessively [ik'sesivli] *ad.* 过多地,极度地

misalignment [misə'lainmənt] *n.* 不重合,安装误差,调整不当

plaster ['plɑ:stə] *n.* 灰泥,灰浆,涂层

buckling ['bʌkliŋ] *n.* 弯曲,压曲,折曲,下垂

collapse [kə'læps] *v.* ;*n.* 倒塌,毁坏,纵弯曲,失去纵向稳定性

stiffness ['stifnis] *n.* 刚度,刚性,坚硬性

constructor [kən'strʌktə] *n.* 建造者,施工人员

precedent ['presidənt] *n.* 先例,惯例;*a.* 在先的,领先的

contradistinction [kɔntrədis'tiŋkʃən] *n.* 对比,截然相反,区别

in contradistinction to M 与 M 截然不同,不同于 M

rational ['ræʃənl] *a.* 合理的,理性的,理论的,有理解能力的

tension ['tenʃən] *n.* 张力,拉力,拉伸; *v.* 拉伸,拉紧

compression [kəm'preʃən] *n.* 压缩,压力,凝缩

indelible [in'delibl] *a.* 不能消除的,不可磨灭的,难忘的

blended ['blendid] *a.* 混合的,混杂的

postulate ['pɔstjuleit] *n.* 假定,设定,先决条件,基本原理

presume [pri'zju:m] *v.* 假定,推测,以为

visualize ['vizjuəlaiz] *v.* 观察,检验,(使)具体[形象,直观]化,设想,想象

diagrammatic [daiəgrə'mætik] *a.* 图解的,图表的,概略的,轮廓的

diagrammatic sketch 示意图

dividend ['dividend] *n.* 股息,利息,收获

aerodynamic [ɛərəudai'næmik] *a.* 空气动力的,气动的

2 Overview of Engineering Mechanics

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, are quieter, 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, 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.

In practice, engineering mechanics methods are used in two quite different ways:

1. The development of any new device requires an interactive, iterative consideration of form, size, materials, loads, durability, safety, and cost.

2. When a device fails (unexpectedly) it is often necessary to carry out a study to pinpoint the cause of failure and to identify potential corrective measures. Our best designs often evolve through a successive elimination of weak points.

To many engineers, both of the above processes can prove to be absolutely fascinating and enjoyable, not to mention (at times) lucrative.

In any "real" problem there is never sufficient good, useful information; we seldom know the actual loads and operating conditions with any precision, and the analyses are seldom exact. While our mathematics may be precise, the overall analysis is generally only approximate, and different skilled people can obtain different solutions. In the study of engineering mechanics most of the problems will be sufficiently "idealized" to permit unique solutions, but it should be clear that the "real world" is far less idealized, and that you usually will have to perform some idealization in order to obtain a solution.

The technical areas we will consider are frequently called "statics" and "strength of materials," "statics" referring to the study of forces acting on stationary devices, and "strength of materials" referring to the effects of those forces on the structure (deformations, load limits, etc.).

While a great many devices are not, in fact, static, the methods developed here are perfectly applicable to dynamic situations if the extra loadings associated with the dynamics are taken into account. Whenever the dynamic forces are small relative to the static loadings, the system is usually considered to be static.

In engineering mechanics, we will begin to appreciate the various types of approximations that are inherent in any real problem:

Primarily, we will be discussing things which are in "equilibrium," i. e., not accelerating. However, if we look closely enough, everything is accelerating.

We will consider many structural members to be "weightless" —

but they never are.

We will deal with forces that act at a "point" —but all forces act over an area.

We will consider some parts to be "rigid" —but all bodies will deform under load.

We will make many assumptions that clearly are false. But these assumptions should always render the problem easier, more tractable. You will discover that the goal is to make as many simplifying assumptions as possible without seriously degrading the result.

Generally there is no clear method to determine how completely, or how precisely, to treat a problem. If our analysis is too simple, we may not get a pertinent answer; if our analysis is too detailed, we may not be able to obtain any answer. It is usually preferable to start with a relatively simple analysis and then add more detail as required to obtain a practical solution.

During the past two decades, there has been a tremendous growth in the availability of computerized methods for solving problems that previously were beyond solution because the time required to solve them would have been prohibitive. At the same time the cost of computers has decreased by orders of magnitude. The computer programs not only remove the drudgery of computation, they allow fairly complicated problems to be solved with ease. Students gain a greater understanding of the subject by simply changing input values and seeing what happens.

Words and Expressions

ceramics [si'ræmiks] *n.* 陶瓷,陶瓷材料

perceive [pə'si:v] *vt.* 感觉,觉察,发觉,领会,理解,看出

inertia [iˈnəːʃiə] *n.* 惯性,惯量,惰性

lifetime 使用寿命,使用期限,持续时间,生存期

interactive [intərˈæktiv] *a.* 相互作用的,相互影响的,交互的

iterative [ˈitərətiv] *a.* 反复的,迭代的,重复的

durability [djuərəˈbiliti] *n.* 耐久性,持久性,耐用期限

pinpoint [ˈpinpɔint] *n.* 针尖;*a.* 极精确的,细致的;*vt.* 准确定位,正确指出,确认,强调

evolve [iˈvɔlv] *v.* 开展,发展,研究出,(经过试验研究等)得出

substance [ˈsʌbstəns] *n.* 物质,材料,内容,要点,梗概

lucrative [ˈljuːkrətiv] *a.* 可获得的,赚钱的,有利的

statics [ˈstætiks] *n.* 静力学

strength of materials 材料力学

deformation [diːfɔːˈmeiʃən] *n.* 变形,形变,畸变

dynamic [daiˈnæmik] *a.* 动力的,动力学的,冲击的

appreciate [əˈpriːʃieit] *vt.* 正确评价,理解,体会到,懂得

(be) inherent *in* 为…所固有,是…的固有性质

false [fɔːls] *a.*; *ad.* 假的,不真实的,似是而非的

render [ˈrendə] *vt.* 提出,给予,描绘,表现

tractable [ˈtræktəbl] *a.* 易处理的,易加工的

prohibitive [prəˈhibitiv] *a.* 禁止的,抑制的,起阻止作用的

meld [meld] *v.* 融合,汇合,组合,合并,归并

order of magnitude 数量级

drudgery [ˈdrʌdʒəri] *n.* 苦差事, 辛苦的工作

greater understanding of the subject 对这个问题(门学科)更深入的理解

3 Stress-Strain Relationship of Materials

The satisfactory performance of a structure frequently is determined by the amount of deformation or distortion that can be permitted. A deflection of a few thousandths of an inch might make a boring machine useless, whereas the boom on a dragline might deflect several inches without impairing its usefulness. It is often necessary to relate the loads on a structure, or on a member in a structure, to the deflection the loads will produce. Such information can be obtained by plotting diagrams showing loads and deflections for each member and type of loading in a structure, but such diagrams will vary with the dimensions of the members, and it would be necessary to draw new diagrams each time the dimensions were varied. A more useful diagram is one showing the relation between the stress and strain. Such diagrams are called stress-strain diagrams (see Fig. 3.1).

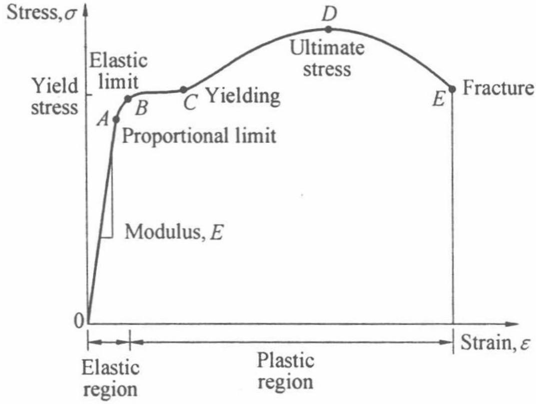

Figure 3.1 Stress-strain curve for a typical low-carbon steel in tension