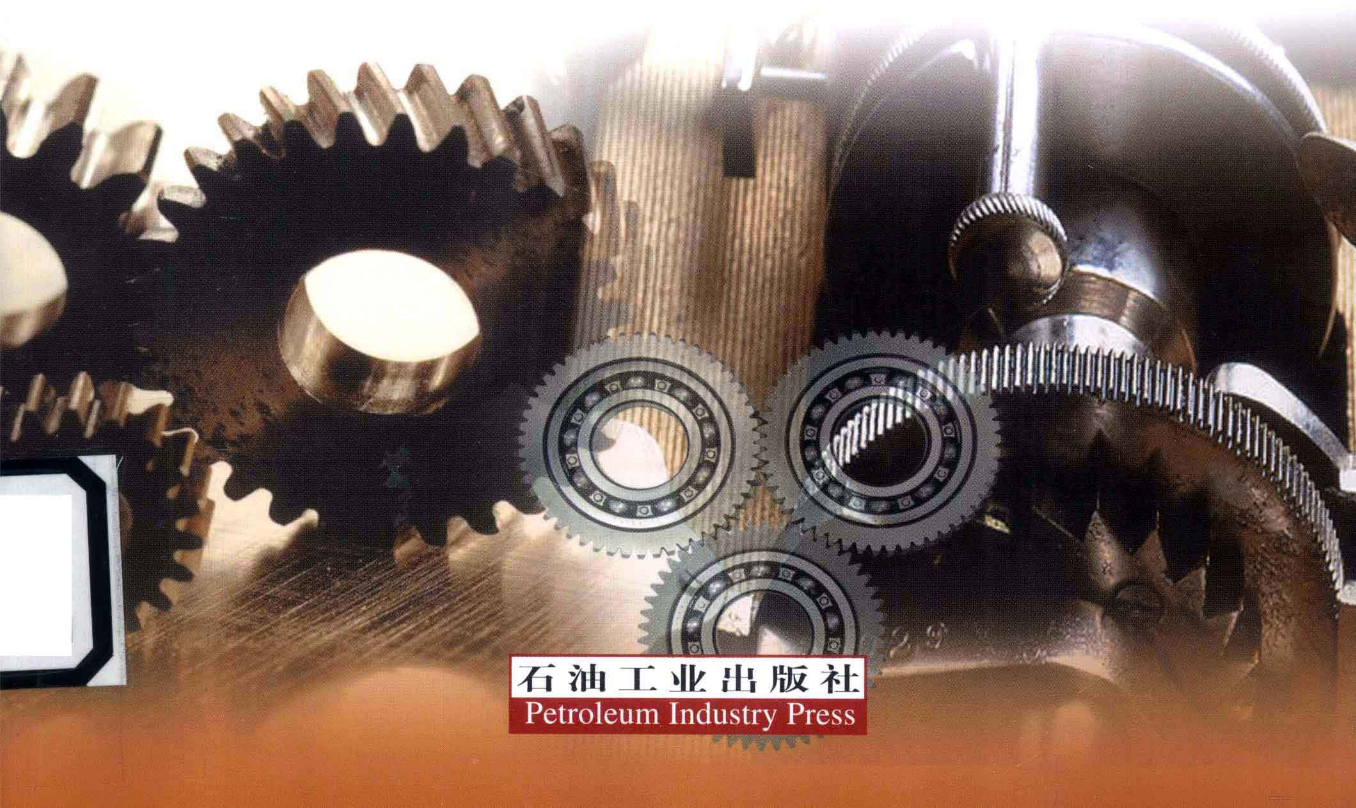
石油教材出版基金资助项目

石油高等院校特色教材

English for Mechanical Engineering

机械工程专业英语

李 枫 主编



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内 容 提 要

本书为机械工程领域机械设计制造及其自动化专业专用教材。全书由20个单元构成，前10个单元为基础篇，后10个单元为提高篇。每个单元以课文为主体，在段落中追加生词、短语与注释，课后进行配套练习，并以独立模块的形式对翻译技巧和专业阅读常识进行介绍，同时增加求职、面试等应用性较强的技巧训练，用以拓宽学生视野、提高其解决实际问题的能力。

本书适合机械设计制造及自动化专业大学本科学生使用，也可作为机械工程领域研究生、工程技术人员及机械类其他专业人员的参考用书。

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前　言

经过多年的机械工程专业英语教学实践，我们深感编写一本内容适当、针对性强和涉及面广的教材，对准确地把握专业英语的教学要求、提高专业英语的教学质量及学生的专业英语水平是何等的重要。本书是编者在总结多年教学实践经验的基础上，依照机械工程专业教学大纲编写而成的。编写过程力求配合全球经济、文化一体化的大背景和学生就业形势的需要，遵循机械专业“宽口径”的培养模式，在教学材料的选择上，既保证专业教学要求，又尽量做到实用性和趣味性，并力求结构简明、易懂，便于教学和自学。

全书共20个单元，前10个单元为基础内容，主要目的是扩充学生的词汇量；后10个单元为专业内容，主要目的是提高学生应用水平。每个单元参考学时为2学时，教师在授课过程中可酌情删减，或可选择部分内容为自学学时，供学生课后独立自学。

本书涉及的词汇丰富，课文内容由浅入深，适合大学生修完四级英语后继续学习专业英语时使用。

本书由东北石油大学机械科学与工程学院李枫、刘彩玉、付海龙和张勇共同编写完成，李枫负责统稿。在本书的编写过程中，得到了机械科学与工程学院机电工程系的大力支持，机械设计制造及其自动化教研室的部分教师提出了很多宝贵意见，研究生刘冬、韩世杰、宋振华和周亮参与了部分绘图、录入工作，在此一并表示感谢。

由于编者水平所限，错误与不当之处在所难免，恳请广大读者提出宝贵意见。

编者

2011年8月

CONTENTS

Unit 1

Part A Text

Mechanical Materials

Mechanical Properties of Materials

The choice of a proper material requires the consideration of such factors as available materials and their relative cost, strength and **rigidity**, resistance to fatigue load, weight, size, shape of the member, **damping** capacity, resilience, toughness, hardness, ductility, electrical and thermal properties, resistance to wear or corrosion, cost of fabrication, casting and forging characteristics, **machinability** and friction characteristics. In general, the material from which a machine element is made must enable that part to perform its function satisfactorily during its life-time, and it must be economically suitable, that is, cost of material, cost of fabrication and cost of maintenance must be considered. The designation of the material and its treatment will appear either on the detail drawing of each machine element or in a list of **instructions** for the shop.

rigidity[riˈdʒiditi]
n. 坚硬,刻板, 刚性, 硬度
damp[dæmp]
n. 湿气
a. 潮湿的
v. 抗冲击,抑制,阻尼
machinability[məʃiːnəˈbiliti]
n. 机械加工性,切削性
instruction [inˈstrʌʃən]
n. 用法说明(书), 教育, 指令

For the optimum use of engineering materials, it is very important to have complete information regarding their mechanical properties such as strength, elasticity, stiffness or rigidity, ductility, hardness, resilience, toughness and creep. The technological properties such as machinability, weldability, forgeability, malleability, bendability, and castability are also equally important for the proper selection of a material because these ultimately decide the manufacturing process to be used for the fabrication of a machine element.

Strength. Strength of a member depends upon the type and nature of loading. It is defined as the ability of the material to withstand deforming action of the applied forces so that the member does not lose its usefulness and performs its required function in the machine. The static elastic strength, σ_e of a material is the maximum stress that can be applied without causing any **permanent** set. This is shown by point A on the stress-strain diagram, Fig. 1 - 1, and is called the elastic limit of the material. The yield strength σ_y, is the stress **magnitude** which corresponds to a definite amount of permanent set, usually 0.10 or 0.20 percent of the original gauge length (Point B on the stress-strain diagram). The ultimate strength or static **fracture** strength σ_u is the maximum stress reached on the **stress-strain** diagram (Point C, Fig. 1 - 1). The endurance strength or endurance limit, σ'_e of a material is the maximum completely reversed stress that can be applied to a standard specimen in reversed bending for an indefinite number of cycles without causing failure. The impact strength is generally expressed as the amount of energy that can be absorbed by a standard **specimen** without failure.

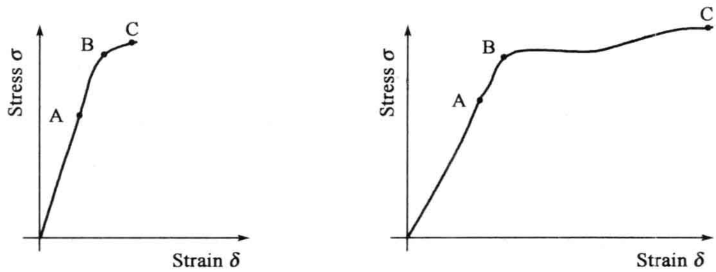
permanent [ˈpəːmənənt]
adj. 永久变形

magnitude [ˈmægnitjuːd]
n. 大小，数量，巨大，广大，量级

fracture [ˈfræktʃə]
n. 破裂，骨折，断裂
v. (使)破碎，(使)破裂

stress-strain [stres-strein]
n. 应力-应变

specimen [ˈspesimən]
n. 样品，样本



(a)Brittle Material (b)Ductile Material

Fig. 1 - 1 Stress-strain diagram

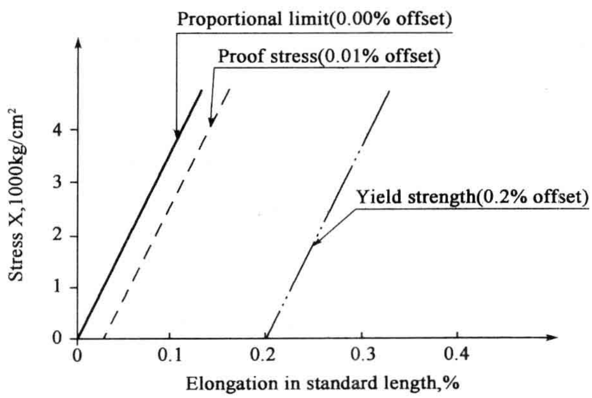


Fig. 1 - 2 Shows the stress-strain diagram for two materials of the same strength and hardness

Elasticity. Elasticity is the property of the material by virtue of which it can regain its original shape and size when deforming forces cease to act. The modulus of elasticity of a material is indicative of its stiffness. Plasticity is the property of the material that enables the formation of considerable permanent deformation in it without rupture. The plastic deformation of the material at temperature lower than **recrystallizaton** range increases its hardness and strength because of strain hardening effect.

recrystallizaton [riː'kristəlaiz] *v*. 重结晶

Ductility and Brittleness. Ductility is the ability of a member to deform plastically prior to **fracture**. Fig. 1-2 shows the stress-strain diagram for two materials of the same strength and hardness. Brittleness and ductility are opposed to each other. The less the plastic deformation prior to failure, the more brittle is the behaviour of a member, or in other words the less ductile is the behaviour. There is no absolute measure of ductility. The percentage elongation and percentage reduction of area of fractured specimens are used to measure the relative ductility of a material. A material having less than 5% elongation is called brittle and one having more is said to be ductile. The ductility of a member is primarily affected by temperature, geometry or complexity of loading and rate of loading. Forming, forging, **peening**, bending, **extruding** , wire drawing and rolling are some of the manufacturing processes that depend on ductility. Ductility of a material makes it extremely useful for members having stress raisers and subjected to cyclic loading. Ductile materials also absorb larger shock load without breaking.

peening[piːning] *n*. 喷丸

extrude[eks'truːd] *v*. 挤压出

Hardness. Hardness is the property of a material to resist penetration, abrasion or scratching and is indicative of wear resistance under certain conditions. It is usually expressed by numbers which are dependent upon the method of making the test. There are four methods that are used to find the hardness of a material, namely Brinell, Rockwell, Vickers and Shore. The first three methods are, however, extensively used. A useful correlation exists between the hardness of a material, the **tensile strength**, endurance limit and wear resistance. The tensile strength of steel in kilograms per square centimeter is approximately 34 times the *BHN*.

tensile strength *n*. 抗拉强度

The Brinell hardness number is experimentally determined by applying a standard load p through a steel ball of standard diameter D. For an **impression** diameter of d, the value is

impression[im'preʃən] *n*. 压印，压痕

$$BHN = \frac{2p}{\pi D(\sqrt{D^2 - d^2})}$$

The Rockwell hardness number is experimentally determined by measuring the depth of penetration or indentation under load tip that may be a steel ball or conical diamond. There are two scales namely B and C for measuring Rockwell hardness of materials. The relationship between the Rockwell hardness and Brinell hardness are given by

$$\begin{cases} R_B = BHN - \dfrac{47}{0.007BHN} + 0.154 \\ R_C = 88(BHN/0.162 - 192) \end{cases}$$

Manufacturing operations such as cold-work, **quenching** and **tempering** change considerably the hardness of a material.

quenching[kwentʃiŋ]
n. 淬火，熄

temper[ˈtempə]
n. 韧度

Toughness. Toughness is the property of a material by virtue of which it can be plastically deformed under a heavy load before **rupture**. It is an extremely desirable property in parts subjected to shock and impact loads. The modulus of toughness is obtained by integrating the stress-strain diagram up to fracture.

rupture[ˈrʌptʃə]
v. 破裂，裂开
n. 破裂，决裂

Resilience. Resilience is the property of a material to absorb energy and to resist shock and impact loads. It is expressed as the amount of energy absorbed per unit volume within elastic range. It is an essential property for spring materials.

Creep. If a part is subjected to a constant stress at high temperature for a long period of time, it will undergo a slow and permanent deformation called creep.

Machinability. The relative ease with which a given material can be machined, or cut with sharp edged tools is called its machinability. The machinability rating of a material is a number, usually a percentage, and refers to the relative ease of cutting as compared to some other material whose cutting properties have been chosen as standard. Good machining steels are usually soft and brittle. At times **sulphur** and **manganese** are added to improve the cutting properties of the materials. Steels of best machinability have *BHN* 187 to 217.

sulphur[ˈsʌlfə]
n. 硫磺

manganese
[ˈmæŋgə,niːz,-,niːs]
n. 锰

Malleability. It is the property of a material that enables it to be hammered or rolled into any desired shape without rupture. Copper and aluminium are malleable metals. Most of the mechanical properties except impact strength tend to decrease with increasing temperature.

These properties of materials can easily be determined in the laboratory by conducting tests on standard specimens. The common tests are:

(1) Tension.

①Ultimate strength.

②Yield strength.

③Elastic strength.

④Percentage elongation.

⑤Percentage reduction in area.

(2) Compression.

(3) Bending.

(4) Torsion.

(5) Fatigue.

(6) Impact.

(7) Hardness.

Factor of Safety

The expressions such as safe stress, allowable or permissible stress and design stress have practically the same meaning. The stress used in designing a machine must be safe stress if failure is not to occur. Such stress in also spoken of as allowable stress.

Within elastic limit, the **deformation** produced is proportional to the applied load. The yield stress occurs when there is a continuous increase in the elongation unaccompanied by increase in the load or stress. The ultimate stress is the maximum stress induced before rupture.

deformation [diːfɔːˈmeiʃən] *n.* 变形

The factor of safety is a number used to obtain the design stress. For this purpose, the ultimate stress, the yield stress, the endurance limit, the creep strength, or some other criterion of strength is divided by the factor of safety. A statement by many designers, that failure occurs when a body ceases to perform its **allotted** function and that most machine elements will not properly work after they have received a permanent deformation, approves of the practice of referring the factor of safety of members with steady loads to the stress of the elastic limit.

allot [əˈlɔt] *vt.* (按份额)分配，分派

On the hand, since it has been the common practice for many years, the factor of safety is referred to the ultimate stress by many designers. Tab. 1 - 1 gives some rule of **thumb values** of factor of safety for guidance for beginners. It should be noted that the same design stress is not necessarily obtained when the

thumb value 经验值

factor of safety is based on the ultimate stress as when it is based on the elastic limits stress.

Tab. 1 − 1 Factor of safety

Type of load	Steel, Ductile metals		Cast irons, Brittle metals	Timber
	Based on ultimate stress σ_u	Based on elastic limit σ_y	Based on ultimate stress σ_u	
Dead	3 ~ 4	1.5 ~ 2	5 ~ 6	7
Repeated, one directional, gradual (mild shock)	6	3	7 ~ 8	10
Repeated, reversed, gradual (mild shock)	8	4	10 ~ 12	15
shock	10 ~ 15	5 ~ 7	15 ~ 20	20

The purpose of using factor of safety is to allow for the following uncertainties which exist in nearly every design.

(1) The maximum loading that will occur in the actual machine.

(2) The estimate of true strength of the material used.

(3) The actual stress distribution or the uncertainty concerning the validity of the strength equation used.

In general, allowable stress, safe stress, or design stress = (ultimate stress or elastic limit stress)/(factor of safety).

The induced stress, as the name implies, is the actual stress induced in a body under a given loading. It may or may not be a safe one. Under a **certain** load, the induced stress will be the yield point stress, which is not ordinarily considered a safe one.

certain[ˈsəːtn] *a.* 某一个

The expression of working stress is frequently used in exactly the same way as the design stress in used and some times in the sense of induced stress. The latter concept is more logical. However, due to its double meaning, the expression ‘working stress’ should be avoided in favour of the more precise expressions, ‘design stress’ and ‘allowable stress’ etc.

A wise choice of values for the factor of safety to be used in a design is essential in order to ensure safety and satisfactory performance, and to avoid using a larger amount of material than necessary. In spite of the fact that the choice of the factor of safety **rest upon** the judgment of the design, there are many

rest upon *prep.* 依靠

considerations that may be involved in making a proper choice, some of which are described below.

(1) Kind of material.

(2) Kind of load.

(3) Nature of **stress distribution**.

(4) Stress concentration.

(5) Chance of an **accidental load**.

(6) Danger to life or property.

(7) Cost.

It is to be remembered that in the final analysis, the choice of the factor of safety rests upon the judgment of the designer, which in turn depends upon his experience.

In fact, designing is necessarily an experimental procedure in many instances. Little is known about the actual maximum loads, and hence a part of a certain material and size is made and tested. If it does not fail, it may be replaced by a smaller size or one made of less expensive material. If it fails, a large part or a stronger material or a change in a particular instance may be determined from experience. As we proceed with this study, we should observe how often the method of determining the design stress is specified for a particular machine element. Then we should remember that these design stresses are based on experience and are subject to such revision as experience may justify.

stress distribution
应力分布
accidental load
随机载荷

Part B Knowledge Points

How to Read the Expressions

1. Fractions(分数)

(1) 1/3→one third

(2) 2/3→two thirds

(3) 346/759→three hundred and forty-six over(by) seven hundred and fifty-nine
→three four six over(by) seven five nine

(4) 1/2→one(a) half

(5) 1/4→one quarter

(6) 3/4→three quarters

(7) $3\frac{4}{5}$→three and four fifths

2. Decimals(小数)

(1) 7.54→seven point five four

(2) 0.352→zero(naught) point three five two

3. Percentages(百分数)

5%→five percent　　r→five per cent

4. Some symbols(一些符号)

(1) ∵ →because　　∴ →therefore

(2) a'→a prime　　a''→a double prime　　a'''→a triple prime

(3) a_1→a sub one　　a_2→a sub two

(4) $\sqrt{A}$→the square root of A　　→the second rood of A

$\sqrt[3]{A}$→the cube root of A　　→the third root of A

$\sqrt[7]{A}$→the seventh root of A　　$\sqrt[n]{A}$→the nth root of A

(5) A^2→the second power of A　　→the square of A　　→A squared

A^3→the third power of A　　→the cube of A　　→A cubed

A^n→the nth power of A

(6) $\sin x$→sin of x　　$f(x)$→a function of x

$\angle a$→angel a　　$|x|$→the absolute value of x

$\log_n x$→log x to the base n　　$(A+B)$→bracket A plus B bracket closed

(7) $3+5=8$→Three plus five equals eight. (and, added to)

$8-3=5$→Eight minus three is equal to five.

$3\times5=15$→Three times five makes fifteen. (multiplied by)

$15\div3=5$→Fifteen divided by three equals five. (over)

$A>B$→A is greater than B. (more)

$A<B$→A is smaller than B. (less)

(8) $A\propto B$→A varies directly as(with) B. (is directly proportional/related to)

Part C　Appending Content

Translation Skills in EST(1)

科技英语的翻译技巧(1)——概述

翻译是一门艺术,一门语言的艺术。翻译的任务在于用一种语言文字忠实而流畅地传达另一种语言文字所包含的思想。英语与汉语在语言体系上有很大差别,不要认为懂得英语就可以轻而易举地翻译出文章来。就科技英语翻译来说,不仅要有较好的英语和汉语水平,而且要有较广的知识面及相关的专业知识,同时要掌握两种语言的对应表达方法。从

一定意义上说，翻译也是一种创作。有时只是为了准确地翻译出一句话，也必须花费许多精力，查阅许多资料才能得到满意的结果。这里我们仅就科技英语汉译过程中的一些表达方法及技巧做一些基本介绍，更多的内容还要在实际训练中去摸索，以便掌握好两种语言的互换规律。

一、翻译的标准

中国近代的伟大的翻译家严复（曾任过北京大学校长）说过，翻译的“三难”是“信、达、雅”。所谓“信”就是对原文的忠实；“达”就是译文要明白畅达；“雅”则要求译文优美流利。

英文科技文章的特点是结构严谨、逻辑性强。在翻译时我们暂且不要求达到“雅”，但也应该做到：

（1）准确完整地表达原文内容，概念清楚，条理分明，不随意增删、歪曲。特别是定义、公式、数据及图表等要准确无误。

（2）译文要流畅易懂，符合语言规范，尤其是使用规范的专业语言。

二、翻译的过程

（一）准备阶段

先阅读或粗读内容提要，了解其内容，然后收集有关资料，包括必要的专业知识，准备好工具书、专业词典等。随着计算机技术的发展，数字图书的使用越来越广泛，专业词典等类的工具书可以直接在计算机或网络上通过使用相关的软件得到支持。

（二）翻译阶段

先将原文粗译成初稿，解决疑难句子与段落，然后在了解全文的基础上进行精译，完整、准确地表达原文，最后根据汉语的特点对译文做必要的调整。

（三）校核阶段

对照原文校正译文中的错误与漏译点，特别是原作者的观点、定义、符号、数据、公式、图表等，不能有任何错误。

在条件允许的情况下，以上三个阶段都可以借助计算机来完成，从而加快翻译的速度，方便语句的修改。

三、英汉在词法、句法上的异同

（一）词类与词义方面

看一个句子，如果辨别不了其中的一些词的词类，就不能透彻地了解句子的含义。汉语中的量词（如：个、张、只、条等）和语气词（如：吗、呢、了、吧等）英语中没有，而英语中的冠词（the, a, an）和引导词（it, there）汉语中没有。此外还要注意：

（1）英语广泛使用名词，在科技语体上尤为明显，而汉语往往用动词，因为汉语的介词少。如：

Determination of testing method. 确定试验方法。

(2)英语中许多词一词多义,要正确选择其词义。以 light 为例:

Turn on the light.(名词) 开电灯。

The box weighs light.(形容词)这个箱子质量轻。

She lighted a lamp.(动词)她点了一盏灯。

(3)许多情况下不要一词一义,要根据上下文决定其意思,对专业性很强的词尤其要注意。如:sucker rod 是抽油杆,如果将其译成 drawing oil pole,专业人员就不知道是什么意思了。再如:As friction manifests itself as a resistance that opposes motion, it is usually considered as a nuisance. 可以译成"摩擦是运动的阻力,因此(阻力)常被看作讨厌的东西。"

(二)句法方面

句子是最基本的语言单位,它表达一个完整的思想,又具有一定的语法特征。因此,翻译时要一句一句地译好。理解一个句子要掌握好以下要领:

(1)抓住句子的主、谓语。再复杂的句子,找到主、谓语,脉络就清楚了。麻烦的是有时主、谓语被省略、顶替、分隔等,本书将在后面做详细介绍。

(2)弄清句子的结构。英语中常用关联词反映各成分之间的并列、主从、因果、让步等关系。特别是复合句子中层次多、结构复杂,分析时应先找出主句,弄清主、谓语,再找从句,明白主从关系,就可以准确地理解全句。

(3)注意句子的词序。陈述句的基本句序是主语—谓语—宾(或表)语,但有时词序倒装。疑问句、感叹句等句子的词序也有倒装。

(4)了解句子的语态。在科技英语中被动语态较多。此外还常用分词、动名词及不定式等语态形式。

Notes

1. The designation of the material and its treatment will appear either on the detail drawing of each machine element or in a list of instructions for the shop. 材料的名称和处理方法必须在各个机械原件的细节图纸上和使用说明书标出。

2. It is defined as the ability of the material to withstand deforming action of the applied forces so that the member does not lose its usefulness and performs its required function in the machine. 它是指材料在特定载荷作用下,抵抗变形保证不失去其可用性和执行其功能的能力。

Exercises

Ⅰ. Translate the following passage into Chinese.

1. Elasticity is the property of the material by virtue of which it can regain its original shape and size when deforming forces cease to act.

2. A wise choice of values for the factor of safety to be used in a design is essential in order to ensure safety and satisfactory performance, and to avoid using a larger amount of material than is necessary.

Ⅱ. Translate the following expressions into Chinese.

1. yield strength　　2. percentage reduction in area　　3. modulus of elasticity

4. Stress concentration 5. wear resistance 6. endurance limit
7. the Rockwell hardness number 8. danger to life or property

Ⅲ. Answer these questions.

1. what does must be considered the material from a machine element ?
2. In order to choose the engineering material, what need to think of ?
3. What does strength of a member depend upon?
4. How many kinds does a material have elongation which is called brittle?