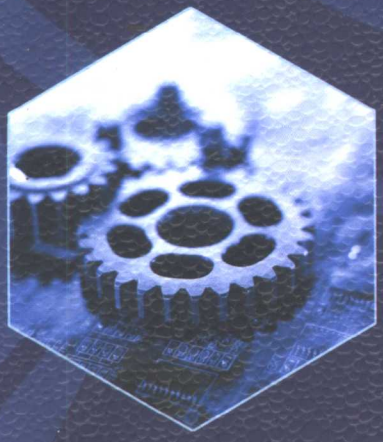
高等学校专业英语教材

机械工程专业英语教程



施 平 主编

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内 容 提 要

本书的主要目的是使读者掌握机械工程专业英语术语及用法，培养和提高读者阅读和翻译专业英语文献资料的能力。本书的主要内容包括：力学，机械零件与机构，机械工程材料，润滑与摩擦，机械制图，公差与配合，机械设计，机械制造，管理，现代制造技术，科技写作。全书共有 68 篇课文及 10 篇阅读材料，其中 30 篇课文有参考译文。

本书可以作为机械设计制造及自动化，机械工程及自动化和机电工程等专业的专业英语教材，也可以供从事机械工程各专业工作的工程技术人员参考使用。

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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》明确规定专业英语为必修课程，要求通过四年不断线的大学英语学习，培养学生以英语为工具交流信息的能力。根据此精神编写了本书，以满足高等院校机械工程各专业学生的专业英语教学需求。

本书所涉及的内容包括：力学，机械零件与机构，机械工程材料，润滑与摩擦，机械制图，公差与配合，机械设计，机械制造，管理，现代制造技术，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本专业常用的及与本专业有关的单词、词组及其用法，而且可以深化本专业的知识，从而为今后的学习和工作打下良好的基础。

全书由68篇课文和10篇阅读材料组成，其中30篇课文有参考译文。本书选材广泛，内容丰富，语言规范，难度适中，便于自学。

本书由施平主编，参加编写的有魏志强，胡明，乔世坤，由贾艳敏担任主审。

由于编者水平有限，书中难免有不足和欠妥之处，恳请广大读者批评指正。

编　者

Contents

Lesson 1 Basic Concept in Mechanics

The branch of scientific analysis which deals with motions, time, and forces is called mechanics and is made up of two parts, statics and dynamics. Statics deals with the analysis of stationary systems, i. e., those in which time is not a factor, and dynamics deals with systems which change with time.

When a number of bodies are connected together to form a group or system, the forces of action and reaction between any two of the connecting bodies are called constraint forces. These forces constrain the bodies to behave in a specific manner. Forces external to this system of bodies are called applied forces.

Electric, magnetic, and gravitational forces are examples of forces that may be applied without actual physical contact. A great many, if not most, of the forces with which we shall be concerned occur through direct physical or mechanical contact. [1]

Forces are transmitted into machine members through mating surfaces, e. g., from a gear to a shaft or from one gear through meshing teeth to another gear, from a V belt to a pulley, or from a cam to a follower. It is necessary to know the magnitudes of these forces for a variety of reasons. The distribution of the forces at the boundaries or mating surfaces must be reasonable, and their intensities must be within the working limits of the materials composing the surfaces. For example, if the force operating on a journal bearing becomes too high, it will squeeze out the oil film and cause metal-to-metal contact, overheating, and rapid failure of the bearing. [2] If the forces between gear teeth are too large, the oil film may be squeezed out from between them. This could result in flaking and spalling of the metal, noise, rough motion, and eventual failure. In the study of mechanics we are principally interested in determining the magnitude, direction, and location of the forces.

Two equal and opposite forces acting along two non-coincident parallel straight lines in a body cannot be combined to obtain a single resultant force. Any two such forces acting on a body constitute a couple. The arm of the couple is the perpendicular distance between their lines of action, and the plane of the couple is the plane containing the two lines of action.

Some of the terms used in mechanics are defined below.

Force Our earliest ideas concerning forces arose because of our desire to push, lift, or pull various objects. So force is the action of one body on another. Our intuitive concept of force includes such ideas as place of application, direction, and magnitude, and these are

called the characteristics of a force.

Matter is any material or substance; if it is completely enclosed, it is called a body.

Mass is a measure of the quantity of matter that a body or an object contains. The mass of the body is not dependent on gravity and therefore is different from but proportional to its weight. Thus, a moon rock has a certain constant amount of substance, even though its moon weight is different from its earth weight. This constant amount of substance, or quantity of matter, is called the mass of the rock.

Inertia is the property of mass that causes it to resist any effort to change its motion.

Weight is the force with which a body is attracted to the earth or another celestial body, equal to the product of the object's mass and the acceleration of gravity.

Particle A particle is a body whose dimensions are so small that they may be neglected.

Rigid Body All bodies are either elastic or plastic and will be deformed if acted upon by forces. When the deformation of such bodies is small, they are frequently assumed to be rigid, i.e., incapable of deformation, in order to simplify the analysis.

Deformable Body The rigid body assumption cannot be used when internal stresses and strains due to the applied forces are to be analyzed. Thus we consider the body to be capable of deforming. Such analysis is frequently called elastic body analysis, using the additional assumption that the body remains elastic within the range of the applied forces.

Newton's Laws Newton's three laws are:

Law 1 If all the forces acting on a particle are balanced, the particle will either remain at rest or will continue to move in a straight line at a uniform velocity.

Law 2 If the forces acting on a particle are not balanced, the particle will experience an acceleration proportional to the resultant force and in the direction of the resultant force.

Law 3 When two particles react, a pair of interacting forces come into existence; these forces have the same magnitudes and opposite senses, and they act along the straight line common to[3] the two particles.

Mechanics deals with two kinds of quantities: scalars and vectors. Scalar quantities are those with which a magnitude alone is associated. Examples of scalar quantities in mechanics are time, volume, density, speed, energy, and mass. Vector quantities, on the other hand, possess direction as well as magnitude. Examples of vectors are displacement, velocity, acceleration, force, moment, and momentum.

Words and Expressions

mechanics[mi'kæniks] *n*. 力学

statics['stætiks] *n*. 静力学,静止状态
dynamics[dai'næmiks] *n*. 动力学,原动力,动力特性
i.e. 那就是,即(= that is)
gravitational[ˌgrævi'teiʃənəl] *a*. 重力的
mating['meitiŋ] *n*.;*a*. 配合(的),配套(的),相连(的)
mating surface 啮合表面,配合表面
e.g. 例如(= for example)
gear[giə] *n*. 齿轮,齿轮传动装置
shaft[ʃɑ:ft] *n*. 轴
meshing['meʃiŋ] *n*. 啮合,咬合,钩住
bearing['bɛəriŋ] *n*. 轴承,支承,承载
lever['li:və 或'levə] *n*. 杠杆,操纵杆,手柄,把手
pulley['puli] *n*. 滑轮,皮带轮,滚筒
cam[kæm] *n*. 凸轮,偏心轮,样板,靠模,仿形板
magnitude['mægnitju:d] *n*. 大小,尺寸,量度,数值
compose[kəm'pəuz] *v*. 组成,构成
journal bearing 滑动轴承
squeeze[skwi:z] *v*. 挤压,压缩;*n*. 压榨,挤压
squeeze out 挤压,压出
flaking['fleikiŋ] *n*. 薄片,表面剥落,压碎;*a*. 易剥落的
spall[spɔ:l] *v*. 削,割,打碎,剥落,脱皮;*n*. 裂片,碎片
noncoincident[ˌnɔnkəu'insidənt] *a*. 不重合的,不一致的,不符合的
parallel['pærəlel] *a*. 并行的,平行的,相同的;*n*. 平行线
resultant[ri'zʌltənt] *a*. 合的,组合的,总的;*n*. 合力,合成矢量,组合
couple['kʌpl] *n*. 力偶,力矩
perpendicular[ˌpə:pən'dikjulə] *a*. 垂直的;*n*. 垂直,正交,垂线
inertia[i'nə:ʃjə] *n*. 惯性,惯量,惰性,不活动
celestial[si'lestʃəl] *a*. 天空的,天体的
incapable[in'keipəbl] *a*. 无能力的,不能的,无用的,无资格的
deformation[ˌdi:fɔ:'meiʃən] *n*. 变形,形变,扭曲,应变
deformable[di'fɔ:məbl] *a*. 可变形的,应变的
acceleration[ækˌselə'reiʃən] *n*. 加速度,加速度值,促进,加快
sense[sens] *n*.;*v*. 感觉,检测,显示,方向
scalar['skeilə] *n*.;*a*. 数量(的),标量(的)
moment['məumənt] *n*. 力矩,弯矩

momentum[məu'mentəm] *n*. 动量，冲量

Notes

1. be concerned with 意为“涉及，与……有关”，physical contact 意为“实际接触，直接接触”。全句可译为：
   与我们有关的力，即使不是大多数的话，也有很多是通过直接的实际接触或机械接触而产生的。
2. operate on 意为“对……起作用，影响”。全句可译为：
   如果作用在滑动轴承上的力太大，它将会把油膜挤出，引起金属与金属的接触、过热和轴承的快速失效。
3. common to 意为“为……所共有”。

Lesson 2 Forces and Their Effects

A study of any machine or mechanism shows that each is made up of a number of movable parts. These parts transform a given motion to a desired motion. In other words, these machines perform work. Work is done when motion results from the application of force. Thus, a study of mechanics and machines deals with forces and the effects of forces on bodies.

A force is a push or pull. The effect of a force either changes the shape or motion of a body or prevents other forces from making such changes. Every force produces a stress in the part on which it is applied. Forces may be produced by an individual using muscular action or by machines with mechanical motion.

Forces are produced by physical or chemical change, gravity, or changes in motion. When a force is applied which tends to stretch an object, it is called a tensile force. A part experiencing a tensile force is said to be in tension. A force can also be applied which tends to shorten or squeeze the object. Such a force is a compressive force.

A third force is known as a torsional force, or a torque since it tends to twist an object. Still another kind of force, which seems to make the layers or molecules of a material slide or slip on one another, is a shearing force.

Each of these forces may act independently or in combination. For example, a downward force applied on a vertical steel beam tends to compress the beam. If this beam is placed in a horizontal position and a load is applied in the middle, the bottom of the beam tends to stretch and is in tension. At the same time, the top area is being pushed together in compression. If the compressive and tensile forces are greater enough to make the layers of the material slide upon each other, a shearing force results.

The turning of a part in a lathe is another example of several forces in action (as shown in Figure 1).[1] As the work revolves and the cutting tool moves into the work, the wedging action of the cutting edge produces a shear force. This force causes the metal to seem to flow off the work in the form of chips.[2] If this workpiece is held between the centers of the lathe, the centers exert a compressive force against the work.[3] The lathe dog which drives the work tends to produce a shearing force. The pressure of the cutting tool against the work produces tension and compression, as well as a shearing action.

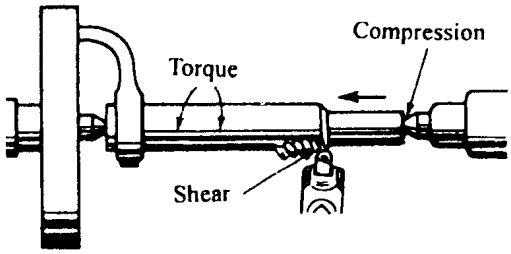

Figure 1 The turning of a part in a lathe

Considerable attention is given to the action of centrifugal force in grinding wheels. That is, the bonding agent that holds the abrasive particles on the wheel must be stronger than the forces which tend to make the revolving wheel fly apart at high speeds. For this reason, the speed of a grinding wheel should not exceed the safe surface speed limit specified by the manufacturer. Centrifugal force increases with speed.

The principles of centrifugal force are used in the design of centrifuge-type machines. Some centrifuges are used to separate chemicals; others are used to remove impurities in metals by centrifugal casting processes. Centrifugal force principles are also used in common appliances such as clothes dryers and in devices to control motor speeds and accelerate moving machines.

Centripetal force causes an object to travel in circular path. This action is caused by the continuous application of forces which tend to pull the object to the center. In other words, the inward force which resists the centrifugal force is called the centripetal force. The centripetal force of objects spinning at a constant rate produces an acceleration toward the center which is equal and opposite to the centrifugal force.

The materials used in the construction of rapidly moving machine parts and mechanisms must be structurally strong enough to provide the centripetal force required to hold the parts to a circular path. At the same time, the materials must be able to withstand the centrifugal force which tends to pull the parts apart.

Motion and the basic laws which affect motion are important considerations because of the numerous applications of these principles to produce work through mechanical devices. There are two primary mechanical motions: rotary and rectilinear. These terms suggest that rotary motion is a circular movement around a center line and rectilinear motion is a straight line motion. For either rotary or rectilinear motion, it is possible, with added mechanical devices, to produce other forms of motion such as intermittent motion and reciprocating motion.

Rotary Motion. The motion that is commonly transmitted is rotary motion. This type

of motion may be produced with hand tools or power tools. Rotary motion is required to drill holes, turn parts in a lathe, mill surfaces, or drive a generator or fan belt.[4]

Rectilinear Motion. The feed of a tool on a lathe, the cutting of steel on a power saw, or the shaping of materials are all situations in which rectilinear or straight line motion produces work. In each of these situations a part or mechanism is used to change rotary motion to straight line motion. The screw of a micrometer and the threads in a nut are still other applications where the direction of motion is changed from rotary to rectilinear.[5]

Harmonic and Intermittent Motion.[6] Any simple vibration, such as the regular back-and-forth movement of the end of a pendulum, is simple harmonic motion.[7] However, many manufacturing processes require intermittent or irregular motion. For example, the fast return stroke of a power hacksaw or shaper ram is desirable because no cutting is done on the return stroke. Therefore, as more time is saved in returning the cutting tool to the working position, the less expensive is the operation.

The combinations of rotary and rectilinear motion obtainable are unlimited because of the large variety of parts such as gears, cams, pulleys, screws, links, and belts which can be combined in many arrangements.

Words and Expressions

muscular['mʌskjulə] *a*.肌肉的
tensile['tensail] *a*.拉力的
in tension 受拉,承受拉应力
compressive[kəm'presiv] *a*.有压力的,压缩的
torsional['tɔ:ʃənəl] *a*.扭转的,扭力的
torque[tɔ:k] *n*.扭矩,转矩
shear[ʃiə] *v*.;*n*.剪,剪切
stretch[stretʃ] *v*.伸长
compression[kəm'preʃən] *n*.压缩,压紧
lathe[leið] *n*.车床;*v*.用车床加工
lathe dog 鸡心夹头,车床夹头
wedging action 楔作用,楔入作用
cutting edge 刀刃,切削刃
cutting tool 切削工具,刀具
centrifugal[sen'trifjugəl] *a*.离心的,离心力的
grinding['graindiŋ] *n*.磨削

grinding wheel 砂轮,磨轮
bonding agent 粘合剂,结合剂
abrasive[ə'breisiv] *n*.研磨剂,磨料
revolving[ri'vəlviŋ] *v*.旋转;*a*.旋转的
fly apart 飞散,粉碎
centrifuge['sentrifju:dʒ] *n*.离心机,离心作用
impurity[im'pjuəriti] *n*.杂质,混杂物
centrifugal casting process 离心铸造法
centripetal[sen'tripitl] *a*.向心的,利用向心力的
clothes dryer 衣物甩干机
rectilinear[ˌrekti'liniə] *a*.直线的,由直线组成的
intermittent[ˌintə:'mitənt] *a*.间歇的,断续的
reciprocating[ri'siprəkeitiŋ] *a*.往复的,交替的
hand tool 手工工具,手操作工具
power tool 动力工具
rotary['rəutəri] *a*.旋转的,转动的
milling['miliŋ] *n*.铣削
shaping['ʃeipiŋ] *n*.刨削
micrometer[mai'krɔmitə] *n*.测微计,千分尺,微米
thread[θred] *n*.螺纹
hamonic[hɑ:'mɔnik] *n*.谐波,谐函数
vibration[vai'breiʃən] *n*.振动
back-and-forth 往复运动,往返运动
pendulum['pendjuləm] *n*.钟摆;*a*.摆动的
simple harmonic motion 简谐运动
irregular motion 不均匀运动,不规则运动
return stroke 回程,返回行程
power hacksaw 动力弓锯
shaper['ʃeipə] *n*.牛头刨床
shaper ram 牛头刨床滑枕
obtainable[əb'teinəbl] *a*.能获得的,可得到的

Notes

1. turning of a part 这里指"对一个零件进行车削加工"。全句可译为:

几个力同时作用的另外的一个例子是在车床上对零件进行车削加工(如图 1 所示)。

2. chip 这里指“切屑”。work 这里指“工件,即 workpiece ”。全句可译为:
这个力使得金属看起来像以切屑的形式从工件上流出来一样。

3. centers of the lathe 意为“车床的两个顶尖”。全句可译为:
如果一个工件被安装在车床的两个顶尖之间,顶尖对工件施加一个压力。

4. rotary motion 意为“回转运动”。全句可译为:
钻孔、在车床上车削零件、铣平面、驱动发电机或风扇的皮带等都需要回转运动。

5. the screw of a micrometer 意为“千分尺中的螺杆”全句可译为:
千分尺中的螺杆和螺帽中的螺纹是把运动方向从转动变为直线的另外一些应用实例。

6. harmonic and intermittent motion 意为“谐和运动和间歇运动”。

7. simple harmonic motion 意为“简谐运动”。全句可译为:
任何简单的振动,例如,摆的下端有规律的往复运动是简谐运动。