21世纪 高职高专通用教材

机械专业英语

陈立德 主编
毕秉钧 主审

上海交通大学出版社

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内 容 提 要

本书是为高职高专机械类专业学生编写的。

全书共有18课，4篇附录。每课包括课文、生词、常用词汇、课文注释、练习、阅读材料等6部分。课文材料大都选自原版书籍，书末附有常用科技英语词组汇编约1600余条。

本书较全面地反映了机械科技的发展概况，同时也突出了科技英语教学的特点。

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前　　言

本书是为提高高职高专机械类专业学生阅读机械专业英语资料的能力而编的。

全书由18课及附录组成。每课包括课文、生词、常用词汇、课文注释、练习、阅读材料等6部分。为了便于自学，所有课文都附有参考译文编于附录之中。书末附有机械专业科技英语常用词组汇编约1600余条。

不少课文材料是从原版书籍中选取的，但有所删改。选文力求题材多样、面广、内容丰富，并以科技英语常用的用法对课文作了必要的说明。

本书由陈立德主编，严德宝副主编。参加本书编写的有：黄传辉（徐州彭城大学）、李光玲（江阴职工大学）、李卫民（泰州职业技术学院）、辛国庆（潍坊职工大学）、钱袁萍（沙洲工学院）、严德宝（上海海运学院）、杜建红（苏州市职业大学）、陈立德（南京金陵职业大学）等。全书由陈立德同志负责统稿。

南京金陵职业大学外语教研室主任毕秉钧副教授担任主审，他花费了大量的宝贵时间与精力仔细地审阅了全部文稿，提出了很多宝贵意见和建议。同时在编写过程中还得到了褚天承等同志的不少具体帮助与支持，在此一并表示衷心的感谢。

由于水平有限，缺点和错误在所难免，恳请广大读者批评、指正。

编者

2001年5月1日

序

发展高等职业技术教育，是实施科教兴国战略、贯彻《高等教育法》与《职业教育法》、实现《中国教育改革与发展纲要》及其《实施意见》所确定的目标和任务的重要环节；也是建立健全职业教育体系、调整高等教育结构的重要举措。

近年来，年轻的高等职业教育以自己鲜明的特色，独树一帜，打破了高等教育界传统大学一统天下的局面，在适应现代社会人才的多样化需求、实施高等教育大众化等方面，做出了重大贡献。从而在世界范围内日益受到重视，得到迅速发展。

我国改革开放不久，从1980年开始，在一些经济发展较快的中心城市就先后开办了一批职业大学。1985年，中共中央、国务院在关于教育体制改革的决定中提出，要建立从初级到高级的职业教育体系，并与普通教育相沟通。1996年《中华人民共和国职业教育法》的颁布，从法律上规定了高等职业教育的地位和作用。目前，我国高等职业教育的发展与改革正面临着很好的形势和机遇：职业大学、高等专科学校和成人高校正在积极发展专科层次的高等职业教育；部分民办高校也在试办高等职业教育；一些本科院校也建立了高等职业技术学院，为发展本科层次的高等职业教育进行探索。国家学位委员会1997年会议决定，设立工程硕士、医疗专业硕士、教育专业硕士等学位，并指出，上述学位与工程学硕士、医学科学硕士、教育学硕士等学位是不同类型的同一层次。这就为培养更高层次的一线岗位人才开了先河。

高等职业教育本身具有鲜明的职业特征，这就要求我们在改革课程体系的基础上，认真研究和改革课程教学内容及教学方法，努力加强教材建设。但迄今为止，符合职业特点和要求的教材却似凤毛麟角，

由泰州职业技术学院、上海第二工业大学、金陵职业大学、上海商业职业技术学院、青岛职业技术学院、济南机械职工大学、潍坊市职工大学、山东商业职业技术学院、江西财经大学职业技术学院、苏州工艺美术职业技术学院、镇江市高等专科学校、常州技术师范学院、南京工业职业技术学院、江南学院、福州大学职业技术学院、芜湖职业技术学院、蚌埠高等专科学校、安徽新华职业技术学院、宁波高等专科学校等60余所院校长期从事高等职业教育、有丰富教学经验的资深教师共同编写的《21世纪高职高专通用教材》,将由上海交通大学出版社陆续向读者朋友推出,这是一件值得庆贺的大好事,在此,我们表示衷心的祝贺。并向参加编写的全体教师表示敬意。

高职教育的教材面广量大,花色品种甚多,是一项浩繁而艰巨的工程,除了高职院校和出版社的继续努力外,还要靠国家教育部和省(市)教委加强领导,并设立高等职业教育教材基金,以资助教材编写工作,促进高职教育的发展和改革。高职教育以培养一线人才岗位与岗位群能力为中心,理论教学与实践训练并重,二者密切结合。我们在这方面的改革实践还不充分。在肯定现已编写的高职教材所取得的成绩的同时,有关学校和教师要结合各校的实际情况和实训计划,加以灵活运用,并随着教学改革的深入,进行必要的充实、修改,使之日臻完善。

阳春三月,莺歌燕舞,百花齐放,愿我国高等职业教育及其教材建设如春天里的花园,群芳争妍,为我国的经济建设和社会发展作出应有的贡献!

叶春生

2000年4月5日

CONTENTS

LESSON ONE

TEXT
MECHANISMS

Mechanisms may be categorized in several different ways to emphasize their similarities and differences. One such grouping divides mechanisms into planar, spherical, and spatial categories①. All three groups have many things in common; the criterion which distinguishes the groups, however, is to be found in the characteristics of the motions of the links.

A planar mechanism is one in which all particles describe plane curves in space and all these curves lie in parallel planes; i. e. the loci of all points are plane curves parallel to a single common plane. This characteristic makes it possible to represent the locus of any chosen point of a planar mechanism in its true size and shape on a single drawing or figure. The motion transformation of any such mechanism is called coplanar. The plane four-bar linkage, the plate cam and follow, and the slider-crank mechanism are familiar examples of planar mechanism. The vast majority of mechanism in use today are planar.

Planar mechanisms utilizing only lower pairs are called planar linkages; they may include only revolve and prismatic pairs. Although a planar pair might theoretically be included, this would impose no constraint and thus be equivalent to an opening in the kinematic chain. Planar motion also requires that axes of all prismatic pairs and all revolute axes be normal to the plane motion.

A spherical mechanism is one in which each link has some point which remains stationary as the linkage moves and in whcih the stationary points of all links lie at a common location; i. e. the locus of each point is a curve contained in a spherical surface, and the spherical surfaces defined by several arbitrarily chosen points are all concentric. The motions of all particles can therefore be completely described by their radial projections, or "shadows", on the surface of a sphere with properly chosen center.

Spherical linkages are constituted entirely of revolute pairs. A spheric pair would produce no additional constraints and would thus be equivalent to an opening in the chain, while all other lower pairs have nonspheric motion. In spheric linkages, the axes of all revolute pairs must intersect at a point.

Spatial mechanisms, on the other hand, include no restrictions on the relative motions of the particles. The motion transformation is not necessary coplanar, nor must it be concentric. A spatial mechanism may have particles with loci of double curvature. Any linkage which contains a screw pair, for example, is a spatial mechanism, since the relative motion within a screw pair is helical.

NEW WORDS

mechanism['mekənizəm] *n.*	机械装置;机构;机械原理
categorize['kætigəraiz] *v.*	分类
planar['pleinə] *a.*	平面的;在同一平面的
spherical['sferikəl] *a.*	球的,球形的,球面的
spatial['speiʃəl] *a.*	空间的,占据空间的
criterion[krai'tiəriən][*pl.* criteria] *n.*	(批评,判断的)标准,准则,判据等
distinguish[dis'tiŋgwiʃ] *v.*	区别,辨别,识别
link[liŋk] *n.*	连接,联系

particle[ˈpɑːtikl] *n.* 质点
locus[ˈloukəs][*pl.* loci] *n.* 轨线
cam[kæm] *n.* 凸轮
follow[ˈfɔlou] *n.* 从动件
prismatic[prizˈmætik] *a.* 棱柱形的
constraint[kənˈstreint] *n.* 强制,强迫;压抑
kinematic[ˌkainiˈmætik] *a.* 运动学(上)的
revolute[ˈrevəljuːt] *a.* 后旋的
stationary[ˈsteiʃənəri] *a.* 不动的,静的,固定的
arbitrarily[ˈɑːbitrərili] *ad.* 任意地,专断地
concentric[kənˈsentrik] *a.* 同(一中)心的,同轴的
projection[prəˈdʒekʃən] *n.* 投影
constitute[ˈkɔnstitjuːt] *v.* 构成,组成
intersect[ˌintə(ː)ˈsekt] *v.* (线)相交,交叉
curvature[ˈkəːvətʃə] *n.* 曲率
helical[ˈhelikəl] *a.* 螺旋的

USEFUL TERMS AND EXPRESSIONS

in common 共同
parallel to 与…平行
be equivalent to 与…等效,相当于…

NOTES

1. All three groups have many things in common; the criterion which distinguishes the groups, however, is to be found in the characteristics of the motions of the links.
尽管这三类机构都有许多共同点,然而分类的区别却在于连杆运动的特性。
however 一词可以位于句首、句中或句末。
(1)位于句首。 例如:

However, brittle materials such as cast iron have high compressive strength but only a moderate tensile strength.

然而，像铸铁那样的脆性材料抗压强度较高，抗拉强度却只有中等水平。

(2) 位于句中。如上述课文例句。

(3) 位于句末。例如：

Most milling machines are similar, however.

然而，绝大多数铣床都是相似的。

2. 介词短语在科技英语中使用较广泛，阅读时应注意具体搭配和含义。

All three groups have many things in common. (have sth. in common)

这三类机构都有许多共同点。

The motion transformation of any such mechanism is called coplanar.

这种机构的运动变换称为"共面"。

The locus of each point is a curve contained in a spherical surface. (be contained in)

每一点的轨迹都是包含在一个球面内的曲线。

A spheric pair would produce no additional constraints and would thus be equivalent to an opening in the chain. (be equivalent to)

一个球面副不会产生额外的约束，因而就相当于开式链。

Many contouring NC machines, such as lathes and vertical milling machines, are of the two-axes type.

许多仿形数控机床如车床和立式铣床都是两轴线型的。

3. 本课摘于伍忠杰编《机械专业英语》。

EXERCISES

Answer the Following Questions:

1. How many groups are mechanisms divided into?

2. How to distinguish three groups?
3. Why is it possible to represent the locus of any chosen point of a planar mechanism in its true size and shape on a single drawing or figure?
4. What does planar motion require?
5. How to describe the motion of all particles in a spherical mechanism?
6. What do the axes of all revolute pairs require in spheric linkages?

READING MATERIAL

Machine Elements

However simple, any machine is a combination of individual components generally referred to as machine elements or parts. Thus, if a machine is completely dismantled, a collection of simple parts remains such as nuts, bolts, spring, gears, cams, and shafts—the building blocks of all machinery. A machine element is, therefore, a single unit designed to perform a specific function and capable of combining with other elements. Sometimes certain elements are associated in pairs, such as nuts and bolts or keys and shafts. In other instances, a group of elements is combined to form a subassembly, such as bearings, couplings, and clutches.

The most common example of a machine element is a gear, which, fundamentally, is a combination of the wheel and the lever to form a toothed wheel. The rotation of this gear on a hub or shaft drives other gears which may rotate faster or slower, depending upon the number of teeth on the basic wheels.

Other fundamental machine elements have evolved from wheel and levers. A wheel must have a shaft on which it may rotate. The wheel is fastened to the shaft with a key, and the shaft is joined to other shafts with couplings. The shaft must rest in bearings, may be started by a clutch or stopped with a brake. It may be turned by a pulley with a belt or a chain connecting it to a pulley on a second shaft. The supporting structure may be assembled with bolts or rivets or by welding. Proper application of these machine elements depends upon knowledge of the force on the structure and the strength of the materials employed.

The individual reliability of machine elements becomes the basis for estimating the overall life expectancy of a complete machine.

Many machine elements are thoroughly standardized.

Testing and practical experience have established the most suit able dimensions for common structural and mechanical parts. Through standardization, uniformity of practice and resulting economies are obtained. Not all machine parts in use are standardized, however. In the automotive industry only fasteners, bearings, bushings, chains, and belts are standardized. Crankshafts and connecting rods are not standardized.

Shafts rotate in some type of support. We call these supports bearings. Bearings keep the shafts steady.

There are various types of bearings: sleeve bearings, ball bearings, roller bearings, etc. We use different types of bearings for different purpose.

Friction gives movement resistance, and lubrication reduces friction. Proper lubrication protects the bearings and makes the movement smooth. Different types of bearings require different oils and greases. Low-speed bearings use grease and high-speed bearings require light oil. Grease gives some resistance to the movement.

LESSON TWO

TEXT
STRESS AND STRAIN

When a force (or load) is applied to a material, it produces a stress in the material. [1] The stress acting on the material is the force exerted per unit area:

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

Stresses may be tensile, compressive or shear in nature. Figure 1 shows a metal block in tension, i. e. [2] the force F is a stretching force which thus increases the length of the block and reduces its cross-section. If the metal block has a cross-sectional area A, then the tensile stress is F/A.

The dimensional change caused by a stress is called strain. In tension (or compression), the strain is the ratio of the change in length to the original length.

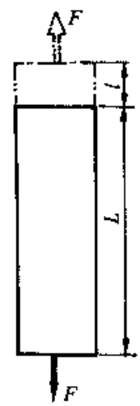

Fig. 1. 1 Metal block in tension

Thus in fig. 1. 1

$$\text{Tensile strain} = \frac{\text{Extension in length}}{\text{Original length}} = \frac{l}{L}$$

Being a ratio, strain is a number without units, but change both in length and original length must be expressed in the same units. Strain may also be expressed as a percentage.

In fig. 1. 2, the force F compresses the metal, thus reducing its length and increasing its cross-section. In this case, the compressive stress is F/A and

$$\text{Compressive strain} = \frac{\text{Reduction in length}}{\text{Original length}} = \frac{l}{L}$$

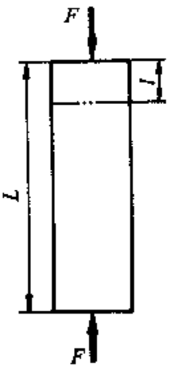

Fig. 1. 2 Metal block in compression

③ In elastic behaviour, the strain produced in a stressed material is completely removed as soon as the stress is removed, so that the material returns to its original dimensions. Some metallic materials show elastic properties up to fairly high stresses, while others have little, if any, elasticity. ④ When an elastic material is loaded progressively in tension, the elastic strain produced is directly proportional to the stress causing it. This relationship is known as Hooke's law. The graph of stress against strain (Fig. 1. 3) will be a straight line passing through the origin. The slope of this straight line (stress/strain) is a constant for a given material. This constant is known as Young's modulus, or the modulus of elasticity, and is denoted by E, so that

$$\text{Modulus of elasticity } E = \frac{\text{Stress}}{\text{Strain}}$$

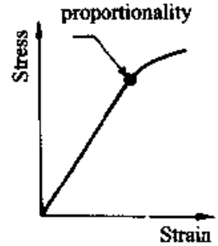

Fig. 1. 3 Stress/Strain curve showing limit of proportionality

Since strain is a dimensionless quantity, E has the same units as stress. ⑤ The value of E is governed by the nature of the material; for steel it is about $2\times10^5 \text{N/mm}^2$ and is not much affected by composition or heat treatment, but decreases with increase in temperature. ⑥ The higher the value of E the more springy a material is.