Unit 1 Mechanism

Passage A

Mechanism

Mechanism may be categorized in several different ways to emphasize their similarities and differences. One such grouping divides mechanism into planar, spherical, and spatial categories. 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 places; 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 co-planar. 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 is planar.

Planar mechanisms utilizing only lower pairs are called planar linkages; they may include only revolute 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 kinematics 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 which 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' axes 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 spherical pair would produce no additional constraints and would thus be equivalent to an opening in the chain, while all other tower pairs have no spherical motion. In spherical linkages, the axes of all revolute pairs must intersect at a point.

Spatial mechanism, on the other hand, include no restrictions on the relative motions of the particles. The motion transformation is not necessary co-planar, 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 and Phrases

mechanism/ˈmekənɪzəm/	*n.*	机构，机械装置，机制
categorize/ˈkætəgəraɪz/	*v.*	加以区别，分类
category/ˈkætəgəri/	*n.*	种类，逻辑范畴
planar mechanism		平面机构
theoretically/ˌθɪəˈretɪklɪ/	*ad.*	理论地
spherical mechanism		球面机构
distinguish/dɪˈstɪŋgwɪʃ/	*v.*	区别，辨别
loci/ˈləʊsaɪ/	*n.*	locus 的复数形式，点的轨迹
concentric/kənˈsentrɪk/	*a.*	同轴的
spatial mechanism		空间机构

→ Exercises

Fill in the blanks according to the text.

1. One such grouping divides mechanism into _____, _____, and _____.

2. _____ is one in which all particles describe plane curves in space and all these curves lie in parallel places.
3. Planar mechanism utilizing only lower pairs are called _____, they may include only revolute and prismatic pairs.
4. _____ is one in which each link has some point which remains stationary as the linkage moves and in which the stationary points of all links lie at a common location.
5. Spatial mechanism, on the other hand, include _____ on the relative motions of the particles.

Translate the following sentences into Chinese.

1. Mechanism may be categorized in several different ways to emphasize their similarities and differences.

_____

2. The loci of all points are plane curves parallel to a single common plane.

_____

3. Planar motion also requires that axes of all prismatic pairs and all revolute axes be normal to the plane motion.

_____

4. In spherical linkages, the axes of all revolute pairs must intersect at a point.

_____

5. A spatial mechanism may have particles with loci of double curvature.

_____

Passage B

Machine Elements

However simple, any machine is a combination of individual components generally referred to machine elements or parts. Thus, if a machine is completely dismantled, a collection of simple parts remains such as nuts, bolts, springs, 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 wheels 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 over all life expectancy of a complete machine. Many machine elements are thoroughly standardized. Testing and practical experience have established the most suitable dimensions for common structural and mechanical parts. Through standardization, uniformity of practice and resulting economies are obtained however. However, not all machine parts in use are standardized. In the automotive industry only fasteners, bearings, bushings, chains, and belts are standardized. Crank shafts and connecting rods are not standardized.

→ New Words and Phrases

machine elements		机械零件
dismantle/dɪsˈmæntl/	*v.*	拆除
nut/nʌt/	*n.*	螺母，螺帽
bolt/bəʊlt/	*n.*	螺栓
spring/sprɪŋ/	*n.*	弹簧
subassembly/ˈsʌbəˈsemblɪ/	*n.*	组件
bearing/ˈbeərɪŋ/	*n.*	轴承

coupling/ˈkʌplɪŋ/	*n.*	联轴器
clutch/klʌtʃ/	*n.*	离合器
gear/gɪə/	*n.*	齿轮
lever/ˈliːvə(r)/	*n.*	杠杆
pulley/ˈpʊlɪ/	*n.*	滑轮
expectancy/ɪkˈspektənsɪ/	*n.*	期望，期待
dimension/daɪˈmenʃn/	*n.*	大小，尺寸
standardize/ˈstændədaɪz/	*v.*	使符合标准

→ Exercises

Translate the following sentences into Chinese.

1. Sometimes certain elements are associated in pairs, such as nuts and bolts or keys and shafts.

_____

2. 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.

_____

3. Other fundamental machine elements have evolved from wheel and levers. A wheel must have a shaft on which it may rotate.

_____

4. The shaft must rest in bearings, may be started by a clutches or stopped with a brake.

_____

5. Testing and practical experience have established the most suitable dimensions for common structural and mechanical parts.

_____

Passage C

Machine Tools

Most of the mechanical operations are commonly performed on five basic machine tools: the drill press; the lathe; the shaper or planer; the milling machine; the grinder.

Drilling

Drilling is performed with a rotating tool called a drill. Most drilling in metal is done with a twist drill. The machine used for drilling is called a drill press. Operations, such as reaming and tapping, are also classified as drilling. Reaming consists of removing a small amount of metal from a hole already drilled. Tapping is the process of cutting a thread inside a hole so that a cap screw or blot may be threaded into it.

Turning

The lathe is commonly called the father of the entire machine tool family. For turning operations, the lathe uses a single point cutting tool, which removes metal as it travels past the revolving work piece. Turning operations are required to make many different cylindrical shapes, such as axes, gear blanks, pulleys, and threaded shafts.

Boring

Operations are performed to enlarge, finish, and accurately locate holes.

Milling

Milling removes metal with a revolving, multiple cutting edge tool called milling cutter. Milling cutters are made in many styles and sizes. Some have as few as two cutting edges and others have 30 or more. Milling can produce flat or angled surfaces, grooves, slots, gear teeth, and other profiles, depending on the shape of the cutters being used.

Shaping and Planing

Shaping and planing produce flat surfaces with a single point cutting tool. In shaping, the cutting tool on a shaper reciprocates or moves back and forth while the work is fed automatically towards the tool. In planing, the work piece is attached to a worktable that reciprocates past the cutting tool. The cutting tool is automatically fed into the work piece a small amount on each stroke.

Grinding

Grinding makes use of abrasive particles to do the cutting. Grinding operations may be classified as precision or nonprecision, depending on the purpose. Precision grinding

is concerned with grinding to close tolerances and very smooth finish. Nonprecision grinding involves the removal of metal where accuracy is not important.

→ New Words and Phrases

drill/drɪl/	*n.*	钻床，钻头
lathe/leɪð/	*n.*	车床
shaper/ˈʃeɪpə/	*n.*	牛头刨床
planer/ˈpleɪnə/	*n.*	龙门刨床
mill/mɪl/	*n.*	铣床
grinder/ˈgraɪndə/	*n.*	磨床
twist trill		螺旋转
ream/riːm/	*v.*	铰孔
tap/tæp/	*v.*	攻丝
pulley/ˈpʊlɪ/	*v.*	滑轮
bore/bɔː/	*v.*	镗削
groove/gruːv/	*n.*	槽口
tolerance/ˈtɒlərəns/	*n.*	公差
cylindrical/səˈlɪndrɪk(ə)l/	*a.*	圆柱形的
abrasive particle		磨料颗粒

→ Exercises

Decide whether each of the following statements is true or false.

1. Most of the mechanical operations are commonly performed on five basic machine tools: the drill press; the lathe; the shaper or planer; the milling machine; the grinder.
2. The machine used for drilling is called a drill press.
3. Tapping is the process of cutting a thread inside a hole so that a cap screw or blot may be threaded into it.
4. Milling can produce flat or angled surfaces, grooves, slots, gear teeth, and other profiles, depending on the shape of the cutters being used.
5. The cutting tool is automatically fed into the work piece a small amount on each stroke.

Translate the following sentences into Chinese.

1. Milling cutters are made in many styles and sizes. Some have as few as two cutting edges and others have 30 or more. Milling can produce flat or angled surfaces, grooves, slots, gear teeth, and other profiles, depending on the shape of the cutters being used.

2. The lathe is commonly called the father of the entire machine tool family. For turning operations, the lathe uses a single point cutting tool, which removes metal as it travels past the revolving work piece.

3. Milling removes metal with a revolving, multiple cutting edge tool called milling cutter.

4. Grinding operations may be classfied as precision or nonprecision.

5. Precision grinding is concerned with grinding to close tolerances and very smooth finish.

Grammar

名词性从句(The Noun Clause)

名词性从句在句子中所起的作用相当于名词，这种从句通常由从属连词 that 引导，也可由 who，whom，whose，what，which，whoever，whatever，whichever 等连接代词引导，还可由 where，when，how，why 等连接副词引导。名词性从句可在句中作主语、宾语、主语补足语(表语)、同位语等。具体列表如下：

名词性从句 在句中的作用	从句名称	常用关联词	例句
作主语	主语从句	that, whether, who, what, which, when, where, how, why	1. That he had got married made us very happy. 2. Whether she will do it is still a question.

续表

名词性从句在句中的作用	从句名称	常用关联词	例句
作宾语	宾语从句	that, whether, if, who (whom), whose, what, which, when, where, how, why	3. We never doubt that he is honest. 4. Please explain why this is impossible.
作主语补足语（表语）	表语从句	that, whether, if, who, what, which, when, where, how, why	5. The fact is that she broke his heart. 6. The question is why he likes this place so much.
作同位语	同位语从句	that	7. We were glad to hear the news that our team had won the game. 8. The fact that his dog died made him very sad.
形容词补足成分	/	that	9. I am sure that you will be very successful. 10. I am afraid that I can't come tomorrow.

名词性从句重难点

1. 名词性从句中引导词 that 可省略的情况：

在所有以 that 引导的名词性从句中，只有在简单宾语从句中（即该从句为简单句时）的引导词 that 可省，其他情况下 that 均不可省。例如上表例句 1 3 5 7 8 9 10 中，只有 3 中的 that 可以省略。

2. 名词性从句中引导词 that 和 what 的区别：

that 在名词性从句中不作句子成分，只起连接作用；而 what 在名词性从句中不仅起连接作用，而且作句子成分。

China isn't what she used to be.

what 在此引导表语从句，且在从句中作 used to be 的宾语。

3. 名词性从句中引导词 whether 和 if 可互换的情况：

在名词性从句中 whether 和 if 都有“是否”的含义，if 在表示此含义时，仅用于宾语从句，且从句中没有“... or not”结构。在该情况下，if 和 whether 可互换，其他情况下只能用 whether.

4. 名词性从句的语序：

名词性从句在句中要用陈述句语序。

No one can be sure $\underset{\text{从句引导词/从句宾语}}{\text{what}}$ $\underset{\text{从句主语}}{\text{our world}}$ $\underset{\text{从句谓语}}{\text{will look like}}$ in a million years.

The teacher asked $\underset{\text{从句引导词/从句主语}}{\text{what}}$ $\underset{\text{从句中系表结构作谓语}}{\text{was the matter}}$ with his students.

5. 名词性从句的时态：

名词性从句的时态应与主句的时态保持一致。

(1)在宾语从句中，当主句是一般现在时，宾语从句可以根据需要用各种时态。

(2)如果主句谓语动词是一般过去时，则宾语从句须用过去的某种时态。

(3)如果宾语从句表示的是客观真理，其谓语动词则仍用一般现在时。

6. 为避免主语冗长，句子头重脚轻，经常用 it 作形式主语，主语从句放在后面作真正的主语。

It is well known/reported/thought/said that...

It is clear/necessary/certain/true/doubtful that...

It is a pity/a shame/an honor that...

It doesn't matter whether... /It seems that...

It happens that...