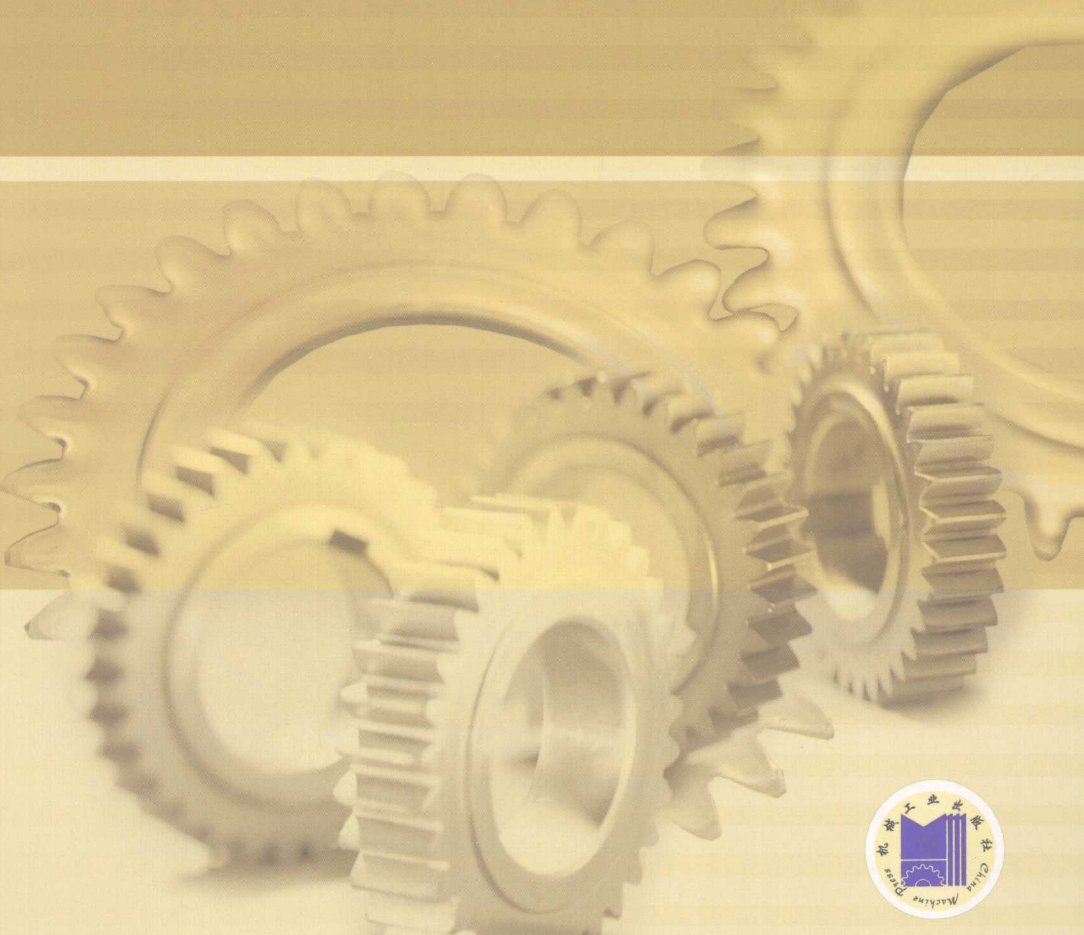
高职高专规划教材

机械制造专业英语

ENGLISH COURSE FOR MECHANICAL ENGINEERING

王晓江　主编



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ENGLISH COURSE FOR MECHANICAL ENGINEERING

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本书是根据“机械制造与自动化专业英语”课程教学大纲编写的。全书分为10章，共38个单元。内容包括机械加工基础知识，工程材料及热处理，工程材料成形方法，刀具、夹具和量具，机床，机械加工工艺，CAD/CAM与数控机床，电加工技术，先进制造技术，质量检测与控制技术等方面。书中的课文和阅读材料大部分节选自100余篇英文原版教材及相关专业英文资料，内容全面，图文并茂，难度适中，融知识性和趣味性于一体，使读者在掌握机械制造专业英语的同时进一步学习机械制造专业的有关知识。为了便于学习，附录A、B中给出了部分专业标准名称对照、专业英语翻译技巧等。

本书为高职高专机械制造专业学生的专业英语教材，也可作为机械类各专业及其他相近专业的教学参考书，同时还可供机械制造专业工程技术人员学习和参考。

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前　言

本书是全国机械职业教育机械制造与自动化专业教学指导委员会规划教材、高等职业教育机电类规划教材。本书是根据“机械制造与自动化专业英语”课程教学大纲编写的，其目的是为了更好地帮助机械制造专业学生进一步适应本专业国际、国内发展的需要，提高直接阅读英语原文和翻译有关专业英语书刊的能力，学习和借鉴国外先进的制造技术，从而大力推进我国机械制造行业的快速发展。本书内容大部分节选自英、美等国专业教材及专业刊物。全书共分10章，38个单元。内容涉及机械加工基础知识，工程材料及热处理，工程材料成形方法，刀具、夹具和量具，机床，机械加工工艺，CAD/CAM与数控机床，电加工技术，先进制造技术，质量检测与控制技术等。

本书可供高职高专机械制造与自动化专业学生使用，也可供有关机械制造类企业的工程技术人员参考。在实际教学中，各院校可根据实际情况调整授课顺序或删减有关内容。

本书由陕西工业职业技术学院王晓江主编（编写第1、2、3章），参加编写的人员还有陕西工业职业技术学院吴兵（编写第4、5章）、魏康民（编写第10章），张家界航空职业技术学院卢端敏（编写第8、9章），河北机电职业技术学院张兆隆（编写第6章），沈阳职业技术学院李学哲（编写附录A、B），包头职业技术学院王靖林（编写第7章）。本书由陕西工业职业技术学院田锋社教授主审，陕西工业职业技术学院澳大利亚籍教师Paul Conroy审阅了全书。

本书在编写过程中得到了张普礼、殷城、侯会喜、钱泉森等同志的大力支持，徐惠、肖春艳老师对教材提出了许多宝贵的修改意见，在此一并表示衷心的感谢。

由于编者水平有限，加上时间紧迫，经验不足，书中难免会有缺点和错误，欢迎读者批评指正。

编　者

CONTENTS

Chapter 1 Fundamentals of Machine Manufacturing

Unit 1 Third-Angle Projection

Text

The six views. Any object can be viewed from six mutually perpendicular directions, as shown in Figure1-1-1a. These six views may be drawn if necessary, as shown in Figure1-1-1b. The six views are always arranged as shown, which is the American National Standard arrangement. The top, front, and bottom views align vertically, while the rear, left-side, front, and right-side views align horizontally. To draw a view out of place is a serious error and is generally regarded as one of the worst possible mistakes in drawing[①].

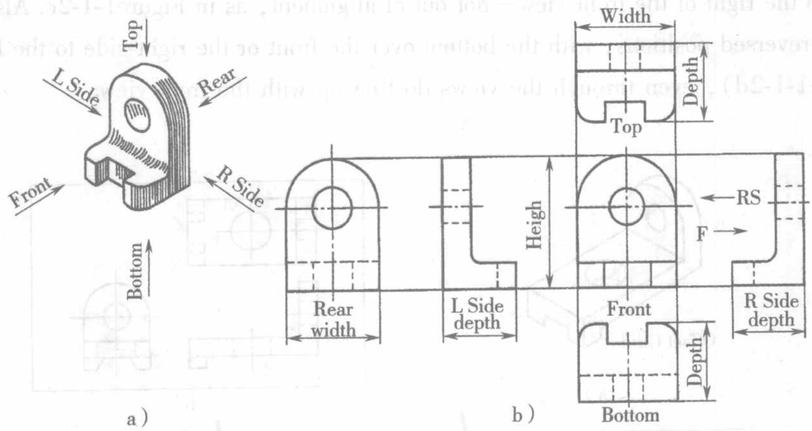

Figure 1-1-1 The six views

Note that height is shown in the rear, left-side, front, and right-side views; width is shown in the rear, top, front, and bottom views; and depth is shown in the four views that surround the front view—namely, the left-side, top, right-side, and bottom views. Each view shows two of the principal dimensions. Note also that in the four views that surround the front view, the front of the object faces toward the front view.

Adjacent views are reciprocal. If the front view in Figure1-1-1 is imagined to be the object itself, the right-side view is obtained by looking toward the right side of the front view, as shown by the arrow RS. Likewise, if the right-side view is imagined to be the object, the front view is obtained by looking toward the left side of the right-side view, as shown by the arrow F. The same relation exists between any two adjacent views.

Necessary views. A drawing for use in production should contain only those views needed for a clear and complete shape description of the object. These minimum required views are referred to as the necessary views. In selecting views, the drafter should choose those that best show essential contours or shapes and have the least number of hidden lines.

As shown in Figure1-1-1, three distinctive features of this object need to be shown on the drawing: (1) rounded top and hole, seen from the front; (2) rectangular notch and rounded corners, seen from the top; and (3) right angle with filleted corner, seen from the side.

The three principal dimensions of an object are width, height, and depth. In technical drawing, these fixed terms are used for dimensions taken in these directions, regardless of the shape of the object②. The terms "length" and "thickness" are not used because they cannot be applied in all cases. The top, front, and right-side views, arranged closer together, are shown in Figure1-1-1. These are called the three regular views because they are the views most frequently used.

Alignment of views. Errors in arranging the views are so commonly made by students that it is necessary to repeat this: The views must be drawn in accordance with the American National Standard arrangement shown in Figure1-1-1. Figure1-1-2a shows an offset guide that requires three views. These three views, correctly arranged, are shown in Figure1-1-2b. The right-side view must be directly to the right of the front view—not out of alignment, as in Figure1-1-2c. Also, never draw the views in reversed positions, with the bottom over the front or the right-side to the left of the front view (Figure1-1-2d), even through the views do line up with the front view.

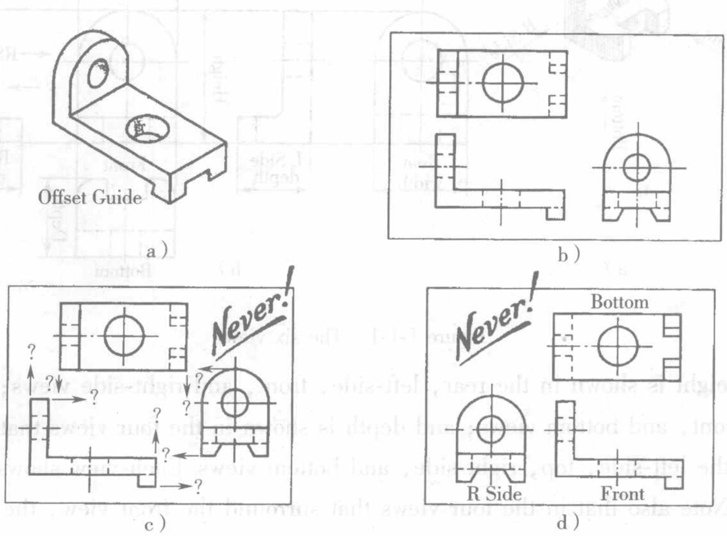

Figure 1-1-2 Position of views

Questions

1. What is the third-angle projection?

2. What are the differences between third-angle projection and first-angle projection?

3. List the six principal views of an object.

4. In a drawing that shows the top, front, and right-side view, which two views show depth? Which view shows depth vertically? Which view shows depth horizontally?

5. What are the three principal dimensions of an object?

New Words and Expressions

1. view[vjuː] n. 视图 vt. 观察
2. projection[prəˈdʒekʃən] n. 投影，发射
3. mutual [ˈmjuːtjuəl] adj. 相互的，共同的
4. perpendicular [pəːpənˈdikjulə] adj. 垂直的，正交的 n. 垂直
5. draw [drɔː] vt. 拉，拖，绘制，描写 vi. 制图
6. arrange [əˈreindʒ] vt. 整理，排列 vi. 安排，准备
7. top [tɔp] n. 顶端，上部 adj. 最高的，顶上的
8. front [frʌnt] n. 正面，前面 adj. 正面的 vt. vi. 面向
9. align [əˈlain] vt. vi. 使成一直线，排列成一行
10. rear [riə] n. 后部，后面 adj. 后面的，后部的
11. adjacent [əˈdʒeisənt] adj. 接近的，毗邻的
12. description [disˈkripʃən] n. 叙述，图说，绘制
13. distinctive [disˈtiŋktiv] adj. 有区别的，特殊的
14. reciprocal [riˈsiprəkəl] adj. 相互的，相应的 n. 倒数
15. arrow [ˈærəu] n. 箭，指针，箭号
16. arrowhead [ˈærəuhed] n. 箭头
17. left-side view 左侧（视）图
18. right-side view 右侧（视）图
19. hidden line (dotted line, dashed line) 隐藏线，虚线
20. be out of (the) perpendicular 倾斜
21. from top to tail (toe) 从头到尾，整个
22. front and rear 在前后；前部和后部
23. in accordance with 按照，依据，与……一致
24. line up with 排成一行
25. be adjacent 靠近，与……邻接
26. be generally regarded as 一般地被看作……，一般地被认为……
27. look toward 面朝，期待；为了……作好准备
28. be referred to as 称为，被认为是

Notes

[1] To draw a view out of place is a serious error and is generally regarded as one of the worst possible mistakes in drawing.

将视图绘制在不适当的位置是一个严重的错误，而且常常被认为是绘图过程中可能出现的最为严重的错误之一。

句中 To draw a view out of place 为不定式短语，在句中作主语；句中 out of place 可译为“不合适，不在适当的位置”；句中 is generally regarded as 可译为“常常被认为……”。

[2] In technical drawing, these fixed terms are used for dimensions taken in these directions, regardless of the shape of the object.

在技术（专业）绘图中，不论物体的形状如何，这些固定术语被用来表示这些方向上的尺寸。

In technical drawing 在句中作状语，可译为“在技术（专业）制图中”；taken in these directions 是过去分词短语作后置定语，可译为“在这些方向上测得的”；regardless of 作“不管”、“不顾”、“不论……如何”解。

Glossary of Terms

1. third-Angle projection　第三角投影
2. first-angle projection　第一角投影
3. mechanical drawing　机械制图
4. standard drawing　标准图
5. standard components (parts) 标准件
6. drawing sheet, drawing paper　图纸
7. drawer, draftsman, drafter　绘图员
8. working drawing　工作图，生产图
9. detail drawing, part drawing　零件图
10. sketch (layout, outline) 草图
11. assembly drawing　装配图
12. design drawing　设计图
13. blueprint　蓝图
14. engineering drawing　工程图
15. structure drawing　结构图
16. machine parts (components)　零（部）件
17. title blocks　标题栏
18. sectional view　剖视图
19. orthographic projection　正投影
20. the top view　俯视投影，俯视图
21. the front view　主视投影（主视图）

22. the side view 侧投影，侧视图
23. the bottom view 仰视图
24. rear (back) view 后视图
25. end view 端视图
26. three-view drawing 三视图
27. pictorial drawing 立体图
28. profile, section (full ~, half ~, offset ~, broken-out ~, rotating ~, inclined ~, compound ~) 剖面（全剖、半剖、阶梯剖、局部剖、旋转剖、斜剖、复合剖）
29. technical requirements 技术要求
30. a detail list of components 零件明细表
31. scale, proportional scale 比例
32. dimensional line 尺寸线
33. descriptive geometry 画法几何
34. dimensioning, size marking 标注尺寸
35. straight line (arc, curve) 直线（圆弧，曲线）
36. horizontal line (incline line, vertical line) 水平线（斜线，垂直线）
37. continuous thick line (full line, visible line) 粗实细
38. continuous thin line 细实线

Reading Materials

First-Angle Projection

If the vertical and horizontal planes of projection are considered indefinite in extent and intersecting at 90° with each other, the four dihedral angles produced are the first, second, third, and fourth angles (Figure1-1-3a).

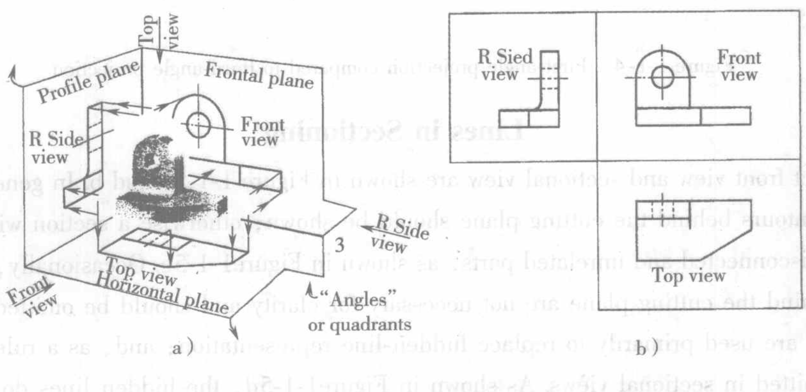

Figure 1-1-3 First-angle projection

If the object is placed above the horizontal plane and in front of the vertical plane, the object is in the first angle. In this case, the observer always looks through the object and to the planes of projection. Thus, the right-side view is still obtained by looking toward the right side of the object, the front by looking toward the front, and the top by looking down toward the top; but the views are projected from the object onto a plane in each case. When the planes are unfolded (Figure1-1-3b), the right-side view falls at the left of the front view, and the top view falls below the front view, as shown. A comparison between first-angle orthographic projection and third-angle orthographic projection is shown in Figure1-1-4. The front, top, and right-side views shown in Figure1-1-3b for first-angle projection are repeated in Figure1-1-4a. Ultimately, the only difference between third-angle and first-angle projection is the arrangement of the views. Still, confusion and possibly manufacturing errors may result when the user reading a first-angle drawing thinks it is a third-angle drawing, or vice versa. To avoid misunderstanding, international projection symbols, shown in Figure1-1- 4, have been developed to distinguish between first-angle and third-angle projections on drawings. On drawings where the possibility of confusion is anticipated, these symbols may appear in or near the title box.

In the United States and Canada (and, to some extent, in England), third-angle projection is standard, while in most of the rest of the world, first-angle projection is used. First-angle projection was originally used all over the world, including the United States, but it was abandoned around 1890.

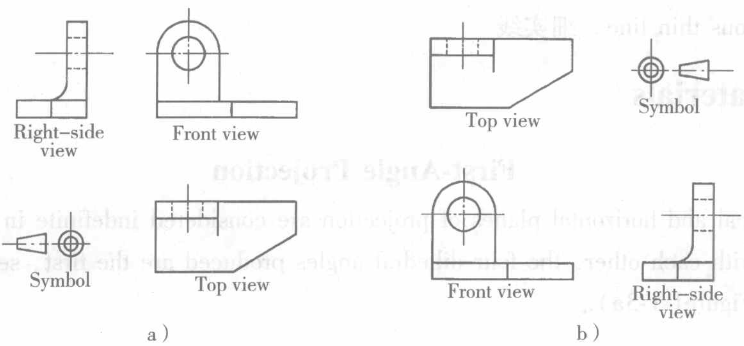

Figure 1-1-4 First-angle projection compared to third-angle projection

Lines in Sectioning

A correct front view and sectional view are shown in Figure 1-1-5a and b. In general, all visible edges and contours behind the cutting plane should be shown; otherwise a section will appear to be made up of disconnected and unrelated parts, as shown in Figure1-1-5c. Occasionally, however, visible lines behind the cutting plane are not necessary for clarity and should be omitted.

Sections are used primarily to replace hidden-line representation; and, as a rule, hidden lines should be omitted in sectional views. As shown in Figure1-1-5d, the hidden lines do not clarify the drawing; they tend to confuse, and they take unnecessary time to draw. Sometimes hidden lines are necessary for clarity and should be used in such cases, especially if their use will make it possible to omit a view.

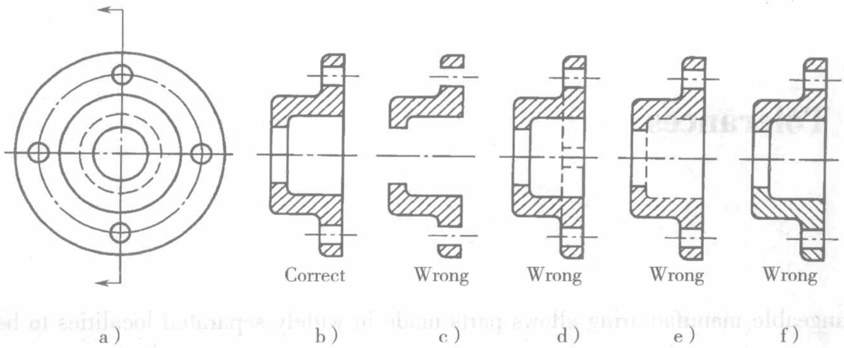

Figure 1-1-5 Lines in sectioning

A section-lined area is always completely bounded by a visible outline—never by a hidden line, as in Figure1-1-5e, since in every case the cut surfaces and their boundary lines will be visible. Also, a visible line can never cut across a section-lined area.

In a sectional view of an object, alone or in assembly, the section lines in all sectioned areas must be parallel, not as shown in Figure1-1-5f. The use of section lining in opposite directions is an indication of different parts, as when two or more parts are adjacent in an assembly drawing.

Unit 2 Tolerances

Text

Interchangeable manufacturing allows parts made in widely separated localities to be brought together for assembly. That the parts all fit together properly is an essential element of mass production. Without interchangeable manufacturing, modern industry could not exist, and without effective size control by the engineer, interchangeable manufacturing could not be achieved[①].

However, it is impossible to make anything to exact size. Parts can be made to very close dimensions, even to a few millionths of an inch or thousandths of a millimeter, but such accuracy is extremely expensive.

Fortunately, exact sizes are not needed. The need is for varying degrees of accuracy according to functional requirements. A manufacturer of children's tricycles would soon go out of business if the parts were made with jet-engine accuracy—no one would be willing to pay the price[②]. So what is wanted is a means of specifying dimensions with whatever degree of accuracy is required. The answer to the problem is the specification of a tolerance on each dimension.

Tolerance is the total amount that a specific dimension is permitted to vary; it is the difference between the maximum and the minimum limits for the dimension. It can be specified in any of the two forms: unilateral or bilateral. In unilateral tolerance, the variation of the size will be wholly on the side. For example, $30^{\ 0}_{-0.02}$ is a unilateral tolerance. Here the nominal dimension 30 is allowed to vary between 30mm and 29.98mm. In bilateral tolerance, the variation will be to both the sides. For example, 30.00 ± 0.01 or $30^{+0.05}_{-0.10}$. In bilateral tolerance, the variation of the limits can be uniform as shown in the former case. The dimension varies from 30.01mm to 29.99mm. Alternatively the allowed deviation can be different as shown in the second case. Here the dimension varies from 30.05mm to 29.90mm.

In engineering when a product is designed it consists of a number of parts and these parts mate with each other in some form. In the assembly it is important to consider the type of mating or fit between two parts which will actually define the way the parts are to behave during the working of the assembly.

Take for example a shaft and hole, which will have to fit together. In the simplest case if the dimension of the shaft is lower than the dimension of the hole, then there will be clearance. Such a fit is termed clearance fit. Alternatively, if the dimension of the shaft is more than that of the hole, then it is termed interference fit. These are illustrated in Figure1-2-1a and b. However in Figure1-2-1c, depending upon the possibilities of dimensions, at times there will be clearance and other times there will be interference. Such a fit is termed as transition fit.

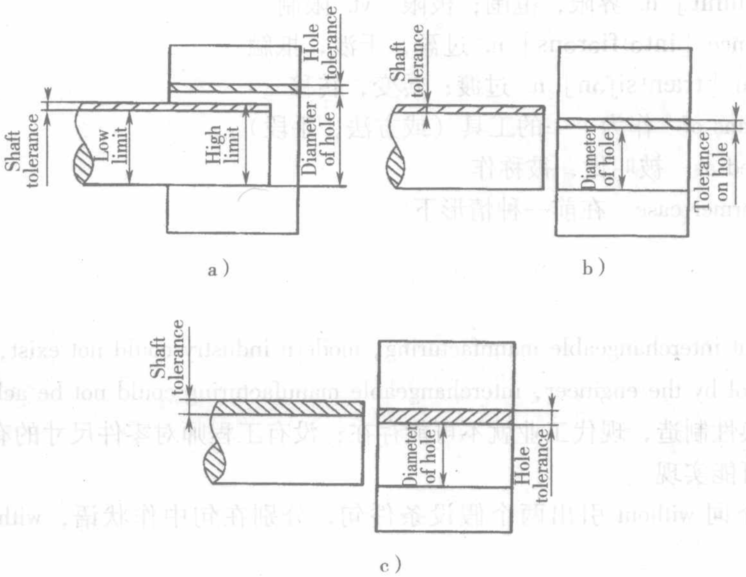

Figure 1-2-1 Typical fits possible in engineering assemblies

Questions

1. Why is it impossible to make anything to exact size?
2. What is the meaning of tolerance?
3. What is the difference between unilateral tolerance and bilateral tolerance?
4. Explain the concepts of clearance, interference and transition fits.

New Words and Expressions

1. interchangeable [intəˈtʃeindʒəbl] adj. 可交换的，可互换的
2. interchangeability [intəːtʃeindʒəˈbiliti] n. 互换性
3. assembly [əˈsembli] n. 集合；装配，组件；装配图
4. millimeter [ˈmiliˌmiːtə] n. 毫米
5. accuracy [ˈækjurəsi] n. 准确（度），精确（度）
6. fortunate [ˈfɔːtʃənit] adj. 幸运的，侥幸的
7. tricycle [ˈtraisikl] n. 三轮车
8. tolerance [ˈtɔlərəns] n. 公差，容差
9. unilateral [juːniˈlætərəl] adj. 单边的，单向的
10. bilateral [baiˈlætərəl] adj. 双边的，两边的
11. wholly [ˈhəuli] adv. 完全地，实足
12. alternatively [ɔːlˈtəːnətiv] adj. 两者挑一的，交替的；选择的
13. deviation [diːviˈeiʃən] n. 偏差，偏离，偏向
14. clearance [ˈkliərəns] n. 间隙，空隙

15. limit [ˈlimit] n. 界限，范围；极限 vt. 限制
16. interference [intəˈfiərəns] n. 过盈，干涉，抵触
17. transition [trænˈsiʃən] n. 过渡；转变，转移
18. as a means of 作为……的工具（或方法，手段）
19. be termed as 被叫做，被称作
20. in the former case 在前一种情形下

Notes

[1] Without interchangeable manufacturing, modern industry could not exist, and without effective size control by the engineer, interchangeable manufacturing could not be achieved.

没有可互换性制造，现代工业就不可能存在；没有工程师对零件尺寸的有效控制，可互换性制造就不可能实现。

该句中由介词 without 引出两个假设条件句，分别在句中作状语，without 作“没有”解。

[2] A manufacturer of children's tricycles would soon go out of business if the parts were made with jet-engine accuracy—no one would be willing to pay the price.

如果童车制造商将童车制造成与喷气式发动机一样的精度，这样不但没有人情愿支付昂贵的价格来购买，而且制造商还将面临很快退出童车市场的境地。

本句为由 if 引导的与现实事实相反的虚拟语气。

Glossary of Terms

1. unilateral tolerance 单边间隙
2. bilateral tolerance 双边间隙
3. clearance fit 间隙配合
4. interference fit 过盈（静）配合
5. transition fit 过渡配合
6. hole-basis (basic-hole) system 基孔制
7. shaft-basis (basic-shaft) system 基轴制
8. basic size 基本尺寸
9. actual size 实际尺寸
10. limit of size 极限尺寸
11. upper (lower) derivation 上（下）偏差
12. error 误差
13. tolerance on fit 配合公差
14. tolerance zone 公差带
15. mass production 成批生产，大批生产
16. standard tolerance 标准公差
17. tolerance grade 公差等级

18. nominal error 名义误差
19. geometric tolerance 形位公差
20. positional tolerance 位置公差
21. working (finishing) allowance 加工余量
22. straightness, flatness, circularity, cylindricity, parallelism, perpendicularity 直线度，平面度，圆度，圆柱度，平行度，垂直度
23. angularity, concentricity, symmetry, roughness, finishing 倾斜度，同轴度，对称度，粗糙度，光洁度
24. total runout (runout) 全跳动（圆跳动）
25. datum (~line, ~plane) 基准（基准线，基准面）
26. setting up error 安装误差

Reading Materials

Hole-Basis and Shaft-Basis System

For obtaining the required fit, the organization can choose any one of the following two possible systems.

Hole-basis system. In this system the nominal size and the limits on the hole are maintained constantly and the shaft limits are varied to obtain the requisite fit. For example,

Let the hole size be $30.00^{+0.03}_{0}$.

Shaft of $30.00^{+0.02}_{-0.01}$ gives the transition fit.

Shaft of $30.00^{+0.08}_{+0.04}$ gives the interference fit.

Shaft of $30.00^{-0.01}_{-0.04}$ gives the clearance fit.

Shaft-basis system. This is the reverse of hole-basis system. In this system the shaft size and limits are maintained constant while the limits of hole vary to obtain any fit.

Though there is not much to choose between the two systems, the hole-basis system is mostly used because standard tools such as reamers, drills, broaches and other standard tools are often used to produce holes, and standard plug gages are used to check the actual sizes. On the other hand, shafting can easily be machined to any size desired.

Preferred Fits

The symbols for either the hole-basis or shaft-basis preferred fits (clearance, transition, and interference) are given in Table 1-2-1. Fits should be selected from this table for mating parts where possible.

Although the second and the third choice basic size diameters are possible, they must be calculated from tables not included in this text. For the generally preferred hole-basis system, note that the ISO symbols range from H11/c11 (loose fit) to H7/u6 (force fit). For the shaft-basis system, the preferred symbols range from C11/h11 (loose fit) to U7/h6 (force fit).