Unit 1 Introduction of Machining
机械加工简介

Objectives

1. To learn about the main structure, function, processing and use scope of Lathe, Miller, and Grinder.
2. To learn about the structure, function, processing and use scope of NC Machine.
3. To learn about the application of Machine Center.

Focus

S: Structure of Lathe (P2)
L: NC Machine Tools (P3)
L: Crashes of Setups (P3)
R: Lathe (P4)
R: Characteristics and Components of CNC Machine Tools (P6)
W: Writing a Brief Introduction to CNC Machine Tools (P8)

1 Starter—Structure of Lathe

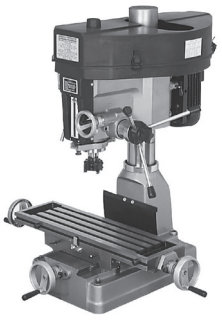
A. Please work with your partner and try to answer the following questions.

1. Have you ever seen or read any books about lathe? If so, what is it used for?

2. What is lathe turning process?

3. Can you tell us one of your experiences related with seeing or using lathe?

B. Look at the following pictures and try to figure out what they are and their functions.



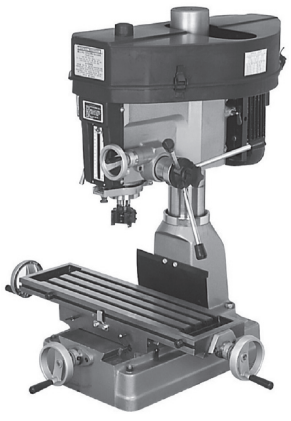
2 NC Machine Tools

Listen to the following conversation and choose the best answer to each question.

1. According to the conversation, what's the relationship between the two speakers? ( )
   A. Friends. B. Colleagues.
   C. Family members. D. Not clear.
2. According to the conversation, how does Nancy like the company these days? ( )
   A. Not bad. B. Not mentioned.
   C. Great. D. Very bad.
3. How many machine tools did Lisa point out in the conversation? ( )
   A. Two. B. Three.
   C. Four. D. Five.

3 Crashes of Setups

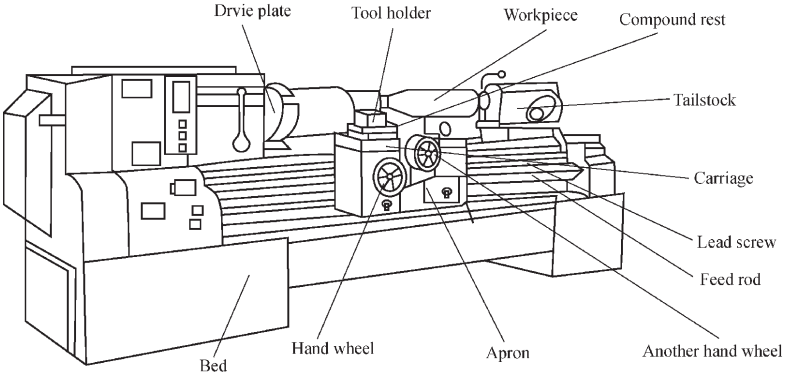
Listen to the following passage and fill in the blanks.



One reason people have trouble trusting qualified (1) _____ has something to do with (2) _____. After a crash, some machines cannot be perfectly re-aligned (though most can with proper (3) _____). If an axis is not perfectly re-aligned, all program zero (4) _____ previously made will no longer be correct. But remember that most (5) _____ have a feature that allows you to shift the machine's coordinate system with one simple fixture offset entry. One popular control calls this the common fixture offset. To use this feature, you must (6) _____ (one time) to find out how much misalignment (7) _____ and enter the misalignment (8) _____ into the common fixture offset.

4 Lathe

Read the following passage and do the exercises.



The purpose of a lathe is to rotate a part against a tool whose position it controls. It is useful for fabricating parts and/or features that have a circular cross section. The spindle is the part of the lathe that rotates. Various work holding attachments such as three jaw chucks, collets, and centers can be held in the spindle. The spindle is driven by an electric motor through a system of belt drives and/or gear trains. Spindle speed is controlled by varying the geometry of the drive train.

The tailstock can be used to support the end of the work piece with a center, or to hold tools for drilling, reaming, threading, or cutting tapers. It can be adjusted in position along the ways to accommodate different length workpieces. The ram can be fed along the axis of rotation with the tailstock hand wheel.

The carriage controls and supports the cutting tool. It consists of: a saddle that mates with and slides along the ways, an apron that controls the feed mechanisms, a cross slide that controls transverse motion of the tool (toward or away from the operator), a tool compound that adjusts to permit angular tool movement, a toolpost T-slot that holds the toolpost.

A. Answer the following questions according to the passage.

1. What's the purpose of a lathe?

2. What can be used to hold tools for drilling, reaming, or cutting tapers?

3. How many parts does the carriage consist of and what are they?

B. Translate the following paragraph in the passage into Chinese.

The purpose of a lathe is to rotate a part against a tool whose position it controls. It is useful for fabricating parts and/or features that have a circular cross section. The spindle is the part of the lathe that rotates. Various work holding attachments such as three jaw chucks, collets, and centers can be held in the spindle.

C. Complete the following sentences with the words or phrases given below. Change the forms if necessary.

rotate	*attachment*	*drive*	*vary*
be adjusted	*consist of*	*workpiece*	*geometry*

1. Sing a song to _____ off those feelings of sadness.
2. The triangle is an important structural shape in _____ and construction.
3. It's an electric drill with a range of different _____.
4. Does the earth _____ on an axis?

5. All electronic computers _____ five units although they are of different kinds.
6. This kind of desk can _____ to the height you need.

5 Characteristics and Components of CNC Machine Tools

Read the following passage and do the exercises.

CNC machine's operation and monitoring are all completed in the numerical control unit, which is the brain of CNC machine tools. Compared with the general machine tools, CNC machine tools have the following characteristics:

- High precision, stable processing quality;
- Can be multi-axis linkage, can process complex shape parts;
- Processing part changes, generally only need to change the NC program, saving the production time of prepareing;
- High precision, rigidity, machine tool itself , can choose the amount of benefit processing, production rate (usually 3 to 5 times as an ordinary machine);
- High degree of automation tools, which can reduce labor intensity;
- A high requirements of the quality for the operators, and a higher one for the maintenance staffs.

CNC machine tools generally consist of the following components:

- Host — it is the subject of CNC machine tools, including machine tools, column, spindle, feed mechanism and other mechanical parts. It is used to complete a variety of machining mechanical parts.
- CNC equipment — CNC machine tools are the core, including the hardware (printed circuit boards, CRT monitors, key boxes, paper tape reader, etc.) and the corresponding software, it used for digital input part program, and completing the input information storage, data transformation, interpolation operations and achieving a variety of control functions.

● Drive — it was the implementing agencies CNC drive components, including the spindle drive unit, feed unit, spindle motor and feed motor. It was under the control of the NC device electrical or electro-hydraulic servo system to achieve through the spindle and feed drive. When several feed linkage, it can complete the position, line, plane curves and space curves processing.

● Assist device — the index control machine tools necessary in supporting components to ensure the operation of CNC machine tools, such as cooling, chip removal, lubrication, lighting, monitoring. It consists of hydraulic and pneumatic devices, chip equipment, pallet, NC rotary table and CNC dividing head, including tools and monitoring detection devices.

● Programming and other ancillary equipment can be used to programming and storing the parts outside the machine.

Since 1952, Massachusetts Institute of Technology developed the world first CNC machine tools been widely used in manufacturing industry, especially in the automotive, aerospace, and military industries; there was also a rapid development of digital technology both in hardware and software.

A. Choose the best answer to each question according to the passage.

1. To _____ can save the production time for preparing. ( )
   A. change the NC program
   B. choose the amount of benefit processing
   C. process complex shape parts
   D. reduce labor intensity
2. _____ is the core of CNC machine tools. ( )
   A. Host
   B. Programming and other ancillary equipments
   C. CNC equipment
   D. Drive
3. CNC machine tools in manufacturing industry has been widely used in the following aspects except _____. ( )
   A. the automotive
   B. steamship
   C. aerospace
   D. military industries

B. Translate the following paragraph in the passage into Chinese.

Since 1952, Massachusetts Institute of Technology developed the world first CNC machine tools been widely used in manufacturing industry, especially in the automotive, aerospace, and military industries; there was also a rapid development of digital technology both in hardware and software.

C. Complete the following sentences with the words given below. Change the forms if necessary.

numerical	*intensity*	*rotary*	*monitoring*
hydraulic	*precision*	*maintenance*	

1. They were _____ the upper air to collect evidence of atomic explosions.
2. Your job is to group them by letter and put them in _____ order.
3. The _____ of the explosion is recorded on the charred tree trunks.
4. His small farm provides _____, but not much more.
5. The central unit is a _____ drum.
6. The _____ system comprises a master cylinder and the slave cylinders.

6 Writing a Brief Introduction to CNC Machine Tools

Write a brief introduction to CNC machine tools based on the information given below.

Key word	CNC machine tools
Fields it concerns	aerospace, marine, automotive and power generation equipment industry
Benefits	● improved automation; ● consistent and accurate workpieces; ● flexibility; ● fast change-over;

7 Supplementary Reading

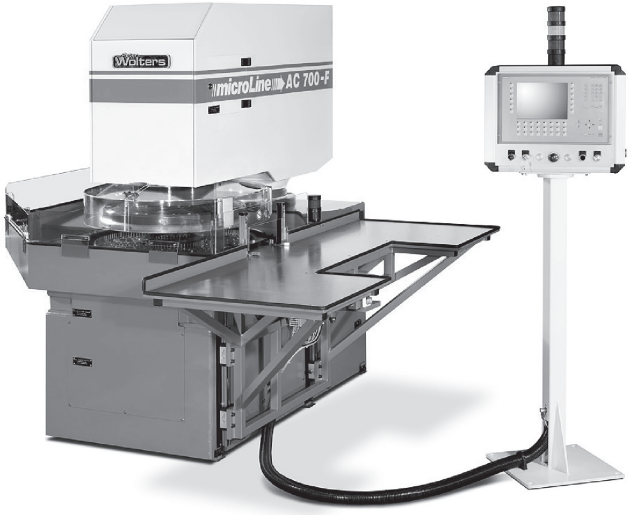
Read the passage and answer the following questions.

1. How many categories can the scope of grinding be divided into? What are they?

2. What is the objective of coarse grinding?

3. What is the objective of fine grinding?

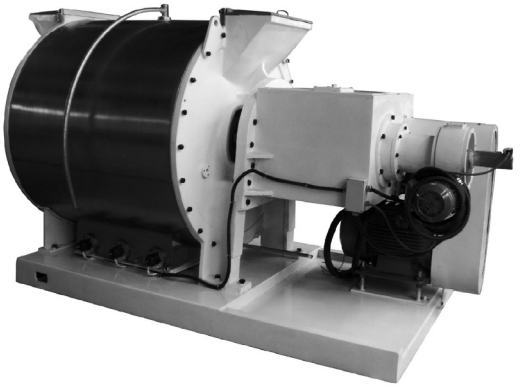
4. What are termed as mechanochemical effect?



Fine Grinding

The scope of grinding can be divided into three categories which are coarse grinding (粗磨), fine grinding (细磨) and mechanical activation, and is distinct by the amount of energy

delivered by the grinding mills (研磨机) to the grinding tools (磨具) and the materials to be ground. The objective of coarse grinding is for size reduction, while mechanical activation is for structural changes of the ground particles to increase the reactivity of the particles. Fine grinding is an intermediate case between coarse grinding and mechanical activation, and is gaining its importance as the demand for fine particles from various industries, such as paper, paint, plastic, pharmaceuticals (医药品), ceramics (陶瓷制品), cosmetics (美容品), foods and fine chemicals is increasing drastically (大幅度地). These industries demand very stringent (严格的) fine particle specifications in terms of particle size and its distribution.



Fine grinding is normally carried out in high intensity grinding mills such as planetary mill (行星式轧机), attrition mill (磨碎机), oscillation mill (振动研磨机) and jet mill (喷磨机). These mills deliver huge amount of energy for particle breakage to produce particles below 10μm. However, mechanochemical effect is induced by fine grinding process when the power bulk density is more than 0.1 kWm-3. The severe and high intensity energy delivered by the grinding mill into the particles leads to structural changes near surface region where the solids come into contact under mechanical forces besides size reduction. The structural changes induces changes in crystallinity, crystallite (微晶，雏晶) size and lattice (格子框架) strain. These changes are generally termed as mechanochemical effect.

Although fine grinding will induce mechanochemical effect that enhances certain properties of the downstream (下游) industries, but certain application needs crystalline particles. The mechanochemical effect can't be avoided during fine grinding process as it happens concurrently with the size reduction process. The challenge is to control the energy intensity induced on the particles so that the ground product can maintain its crystallinity if needed.

Vocabulary

New Words

confuse /kənˈfjuz/ *v.* 混淆；搞错	Don't confuse me with technicalities — all I need to know is how to turn the machine on and off.	1.2
common /ˈkɒmən/ *a.* 普通的；通俗的	Electronic computers are now in common use all over the world.	1.2
spindle /ˈspɪndl/ *n.* 纺锤，纱锭；轴	Screw hollow and motor spindle are distributed staggered and equally.	1.2
setup /ˈsetʌp/ *n.*（软件或硬件的）安装，设置	This setup consists of a butterfly valve and a rotary electromechanical actuator.	1.3
crash /kræʃ/ *n.* 破产；撞车事故；（机器或系统，尤指计算机或计算机系统的）崩溃；突然发出的巨响	The impact of the crash hurtled the driver against the windshield of the car.	1.3
aligned /əˈlaɪnd/ *a.* [计]对准的，均衡的	The processor uses instructions that are four bytes long and word-aligned.	1.3
axis /ˈæksɪs/ *n.* 轴，轴线	The direction of the axis changes gradually so that it traces out a cone in space.	1.3
control /kənˈtrəʊl/ *n.* 控制；限制；（对国家、地区、机构等的）管理权；（键盘上的）控制键	She explained the controls of the washing machine.	1.3
feature /ˈfɪtʃə/ *n.* 特征，特点；容貌，面貌；（期刊的）特辑；故事片	Its most prominent feature is the massive beam.	1.3
coordinate /kəʊˈɔːdɪneɪt/ *n.* [数]坐标；（颜色协调的）配套服装；	The expanded form of the equation will depend upon the selected coordinate system.	1.3
fixture /ˈfɪkstʃə/ *n.*（房屋等的）固定装置	The cordless kettle may now be a fixture in most kitchens.	1.3
measure /ˈmeʒə/ *v.* 测量；估量	You'd better measure the flow of water over the dam.	1.3
rotate /rəʊˈteɪt/ *v.* 轮流；（使）旋转	He rotates the handle gently.	1.4
fabricate /ˈfæbrɪkeɪt/ *v.* 编造；虚构；制造	In China, we have many factories that are professional works to fabricate any kinds of auto parts.	1.4
attachment /əˈtætʃmənt/ *n.* 附件；附属物；忠诚；依恋	For simplicity, we use only one attachment for out test.	1.4

chuck /ʧʌk/ *n.* 卡盘；抛掷 *v.* 扔；抛掷；撵走	The product is hand-operated independent chuck, with cylindrical center mount.	1.4
collet /ˈkɒlɪt/ *n.* 夹头；宝石座	The collet shall be renewed when it is gravely oxidated.	1.4
geometry /dʒɪˈɒmətrɪ/ *n.* 几何；几何学	Leon didn't finish his geometry homework because his mind kept jumping the track to think about the new girl in class.	1.4
tailstock /ˈteɪlstɒk/ *n.* （机床的可调整或可滑动的）尾座	The horizontal bed is the foundation member which supports the headstock, tailstock, and carriage.	1.4
workpiece /ˈwɜːkpiːs/ *n.* 工件	The grinding machine raises the precision of the workpiece and improves its surface finish.	1.4
drill /drɪl/ *n.* 钻孔机；钻子；播种机 *v.* 练习；钻孔；（军事）训练	The workman is drilling in the wall.	1.4
ream /riːm/ *n.* 令（纸张的计数单位）；铰孔 *v.* 扩展；榨出（果汁等）	Recommended for heavy duty machining of soft aluminium and ferrous materials, such as tapping, ream and sawing.	1.4
thread /θred/ *n.* 线；螺纹；思路；线索 *v.* 穿过	Can you thread this needle for me? I'm all fingers and thumbs today.	1.4
accommodate /əˈkɒmədeɪt/ *v.* 供给住宿；使适应；容纳	The builder heightened the doorway to accommodate the tall owner.	1.4
transverse /trænzˈvɜːs/ *a.* 横向的；横断的 *n.* 横向物；横断面	A transverse bar joins the two posts.	1.4
permit /pəˈmɪt/ *n.* 许可证；执照；*v.* 允许；许可	I'll come after the meeting if time permits.	1.4
toolpost /tuːlpəʊst/ *n.* 刀架	An auto-reverse toolpost for high speed cutting triangular thread is introduced.	1.4
monitoring /ˈmɒnɪtərɪŋ/ *n.* 监视；控制；监测；追踪	Monitoring is yet another pillar of management.	1.5
numerical /njuːˈmerɪkəl/ *a.* 数字的；用数字表示的；数值的	The numbers are in numerical order.	1.5
precision /prɪˈsɪʒn/ *n.* 精确度，准确（性） *a.* 精确的；细致的	All kinds of precision machine tools are made in this factory.	1.5
stable /ˈsteɪbl/ *a.* 稳定的；坚定的；牢固的	This structure must be stable.	1.5
linkage /ˈlɪŋkɪdʒ/ *n.* 联系，连接；联动装置；[电]耦合	The motion of the slack diaphragm is transmitted through a mechanical linkage to an indicating scale.	1.5

rigidity /rɪˈdʒɪdətɪ/ *n.* 坚硬；严格；刚直；死板	The amount of force needed is inversely proportional to the rigidity of the material.	1.5
intensity /ɪnˈtensətɪ/ *n.* 强烈；（感情的）强烈程度；强度	He is doing research on radiant intensity.	1.5
maintenance /ˈmeɪntənəns/ *n.* 维持，保持；保养，维护；维修	He learnt CNC machine tools maintenance.	1.5
component /kəmˈpəʊnənt/ *n.* 成分；零件	Blade and handle are the component parts of a knife.	1.5
column /ˈkɒləm/ *n.* 纵队，列；圆柱	The explosion sent a column of smoke thousands of feet into the air.	1.5
rotary /ˈrəʊtərɪ/ *a.* 旋转的 *n.* 旋转式机器；环行交叉路	A control system for a new diesel rotary distributor pump is here introduced.	1.5
interpolation /ɪnˌtɜːpəˈleɪʃn/ *n.* 插入；篡改；添写	For intermediate doses, the corresponding slant distances can be estimated by interpolation.	1.5
circuit /ˈsɜːkɪt/ *n.* 电路，线路；巡回；环形道；[电]电流	This is a semiconductor integrated circuit.	1.5
servo /ˈsɜːvəʊ/ *n.* 伺服，伺服系统；随动系统	He is now working on novel servo mechanisms, the basic building blocks for robots.	1.5
lubrication /ˌlʊbrɪˈkeɪʃn/ *n.* 润滑	Sludge can also clog oil passages and prevent normal engine lubrication.	1.5
hydraulic /haɪˈdrɒlɪk/ *a.* 液压的；水力的	Hydraulic jacks under the machine produce the movement.	1.5
pneumatic /njuːˈmætɪk/ *a.* 充气的；气动的	Pneumatic conveying requires comparatively high gas velocities.	1.5
chip /tʃɪp/ *n.* 碎片；缺口；（作赌注用的）筹码；*v.* 刻，削成；凿；削成一小片的	This company pioneered the use of silicon chip.	1.5
pallet /ˈpælɪt/ *n.* 托盘；平台；运货板；草垫子	This factory has good management and maintenance for wave pallet, and other process tooling.	1.5
ancillary /ænˈsɪlərɪ/ *a.* 辅助的；补充的；附属的；附加的 *n.* 助手，随从	Hose automatic production line is the other ancillary facilities.	1.5
automotive /ˌɔːtəˈməʊtɪv/ *a.* 自动的；汽车的	The automotive industry is the mainstay of the country's economy.	1.5
aerospace /ˈeərəʊspeɪs/ *n.* 航空与航天空间；宇宙空间；航空航天学 *a.* 宇宙空间的；宇宙航行的	In the context of the modern aerospace industry these problems are seldom simple or routine.	1.5

Phrases and Expressions

cross section	横截面	1.4
be adjusted to	适用于	1.4
consist of	包括	1.4
a variety of	多种的；种种	1.5