me270hw2 Machining questions

1 Which materials cannot be machined:

Materials that have volumes smaller than 1 cubic inch.

Things that are especially brittle such as many ceramics and glass.

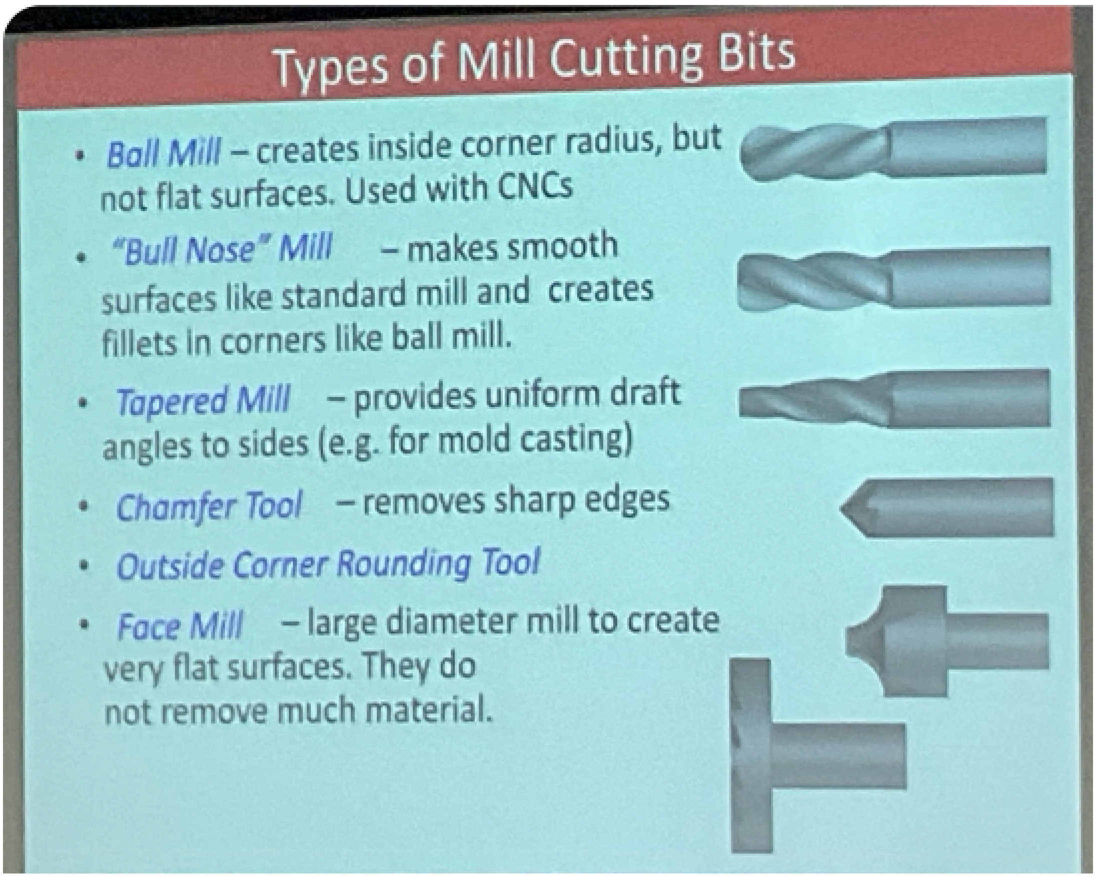
Parts made by rapid prototype.

Foam structures.

Expensive materials.

Things that are especially brittle such as many ceramics and glass

23 Identify this part:



4 Select all that apply. A roughing cut:

Is done at low cutting speeds
Has a small feed and depth of cut
Removes large amounts of material
Improves the final surface finish

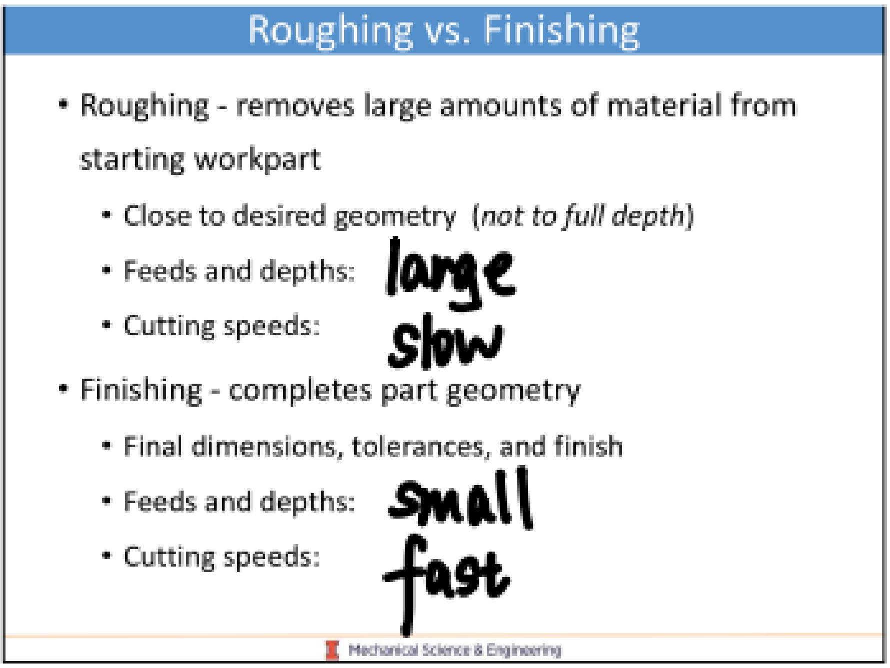
Is done at high cutting speeds

Has a large feed and depth of cut

Is done at low cutting speeds

Removes large amounts of material

Has a large feed and depth of cut



大慢是粗糙的象征

5 In a turning operation, select all that apply:

The cutting operation will have circular symmetry.

It is done on a machine called a Lathe

A rotating cutting tool is moved toward a nonrotating workpiece.

A rotating workpiece is moved toward a nonrotating cutting tool.

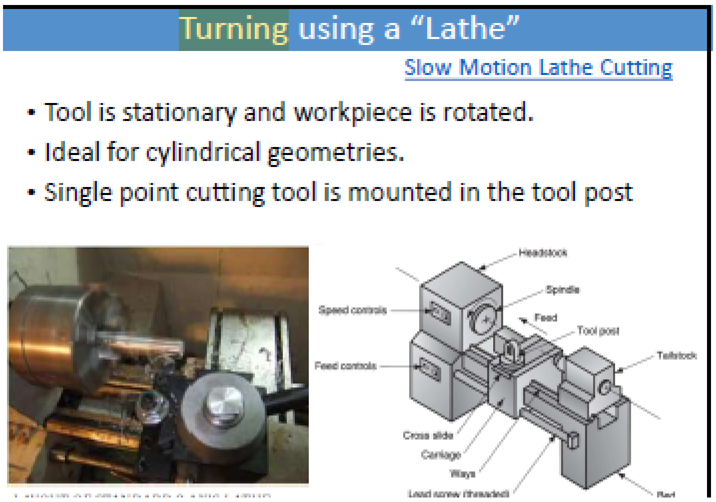
It is done on a machine called a Mill

是工件旋转，而刀具不旋转

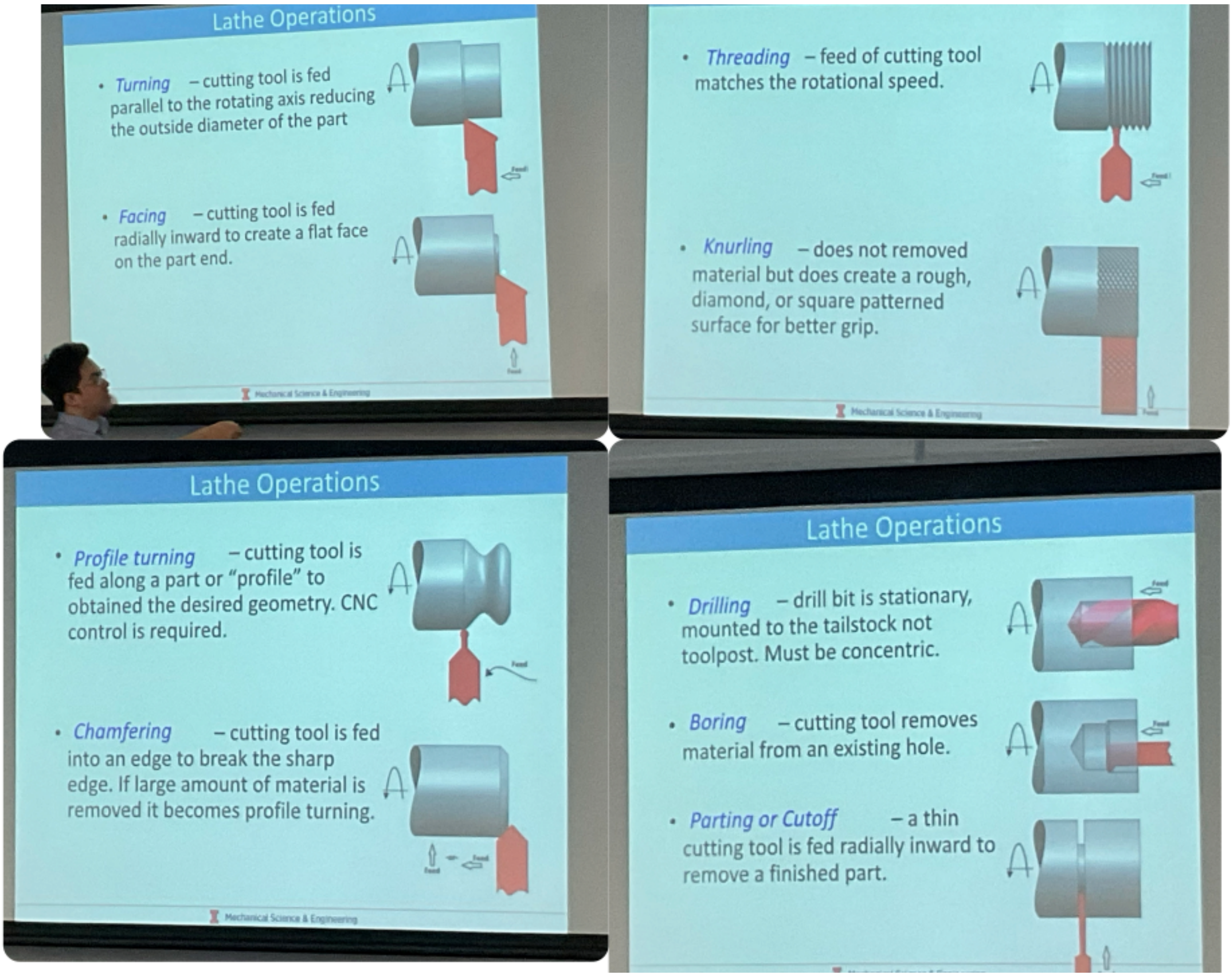
The cutting operation will have circular symmetry.

It is done on a machine called a Lathe

A rotating workpiece is moved toward a nonrotating cutting tool.



678 identify



1. **Chamfering**（倒角）：
   - 倒角是去除工件边缘的锐利部分，以形成斜面或角落的过程。这有助于减少应力集中并改善工件的外观。
2. **Grooving**（开槽）：
   - 开槽是在工件上切割出一条细长的凹槽或沟槽的过程。这通常用于创建键槽或其他类型的凹槽。
3. **Threading**（攻丝或套丝）：
   - 攻丝是在圆柱形工件上切割出螺纹的过程。套丝则是在孔中切割出内螺纹。
4. **Boring**（镗孔）：
   - 镗孔是扩大或精加工已有孔的过程，通常用于提高孔的尺寸精度和表面光洁度。
5. **Cutoff**（切断）：
   - 切断是将工件的一部分从另一部分分离的过程，通常用于将长工件切割成较短的段。
6. **Parting**（分断）：
   - 分断类似于切断，但通常用于将工件精确地分割成多个部分，特别是在需要非常精确的尺寸时。
7. **Knurling**（滚花）：
   - 滚花是在工件表面创建一系列凹槽或凸起的纹理的过程，以增加摩擦力，通常用于改善握持或装配。
8. **Drilling**（钻孔）：

- 钻孔是在工件上创建一个圆形孔的过程，通常使用旋转的钻头。

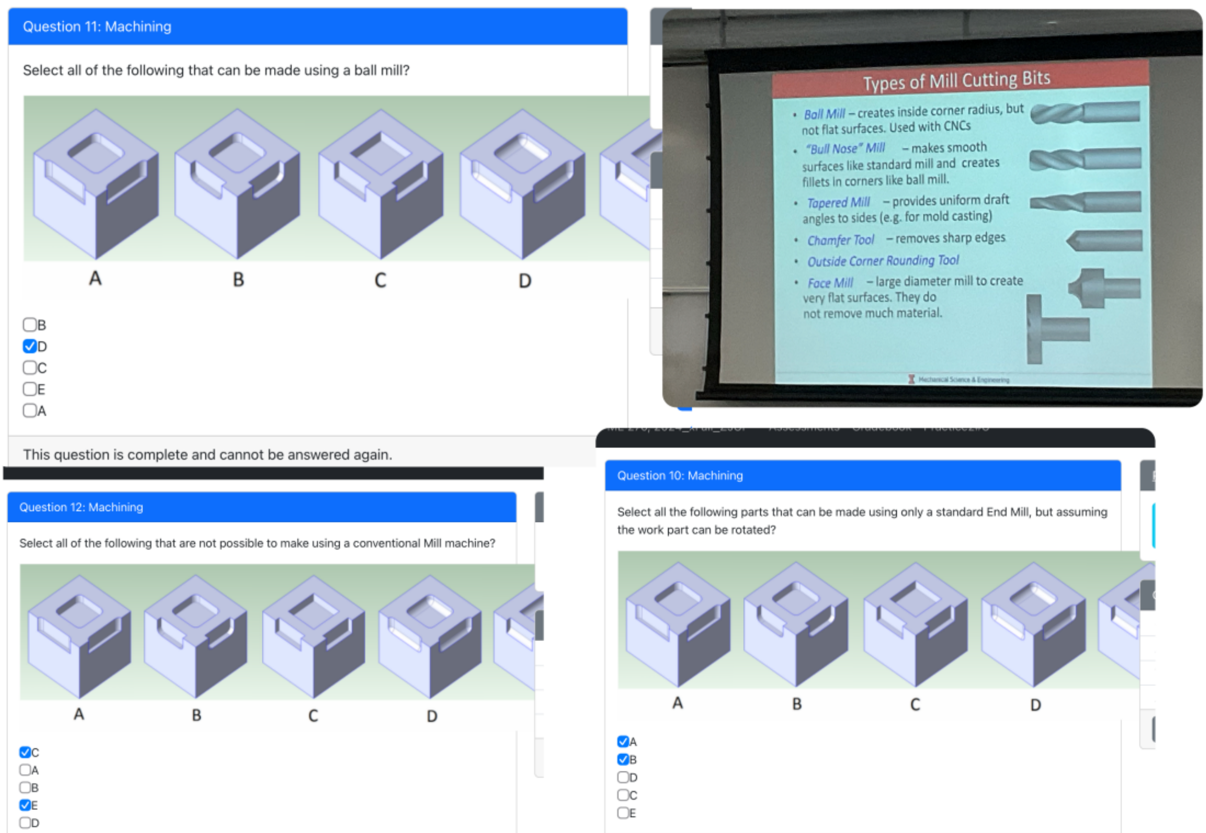
9. **Tapping**（攻丝）：
   - 攻丝是在孔中切割出内螺纹的过程，通常使用称为丝锥的工具。
10. **Facing**（车平面）：
    - 车平面是在工件的端面上进行切削，以获得平整、精确的表面。
11. **Profile-Turning**（轮廓车削）：
    - 轮廓车削是车削操作的一种，其中工件的轮廓被复制到工件上，通常用于制造复杂的三维形状。
12. **Threading**（螺纹加工）：
    - 螺纹加工是一个通用术语，可以指攻丝或套丝，即在工件上创建螺纹。

9 A single point cutting tool to remove material from the inside of an existing hole:

Drilling
Boring
Lapping
Honing

Boring

101112



select all the following parts that can be made using only a standard End Mill, but assuming the work part can be rotated?
B A
Select all of the following that can be made using a ball mill?

D
Select all of the following that are not possible to make using a conventional Mill machine?
E C

13 Reaming is used for which of the following:

To improve the diameter tolerance of a hole.
To improve the surface finish inside a hole.
To more accurately set the position of a hole.
To start a hole in order to keep a drill bit from "walking" across the surface.
Is needed before tapping a hole.

To improve the diameter tolerance of a hole.
To improve the surface finish inside a hole.

铰孔（Reaming）是一种金属加工技术，它使用一种称为铰刀（Reamer）的旋转切削工具来精确地扩大预先存在的孔，并提高其尺寸精度和表面光洁度。以下是铰孔操作的一些关键特点和用途：

1. **提高直径公差**：铰孔可以改善孔的直径公差，使其达到非常精确的尺寸，通常用于需要精确配合的孔加工。
2. **改善孔内表面光洁度**：铰孔操作可以去除孔内的毛刺和钻孔时留下的螺旋痕迹，提供非常光滑的表面，这在钻孔后是难以实现的。
3. **不能更准确地设置孔的位置**：铰孔本身并不用于设置孔的位置；孔的位置应在之前的加工步骤中确定。铰孔主要是为了提高已经钻好的孔的尺寸精度和表面光洁度。
4. **不是用于防止钻头在表面上“行走”**：为了防止钻头在开始钻孔时在工件表面游走，通常会使用中心冲或中心钻来进行初始的定位孔加工。
5. **在攻丝之前通常是必需的**：在对孔进行攻丝以制作螺纹之前，铰孔是一个推荐步骤，因为它可以确保孔具有正确的尺寸和表面光洁度，从而使得攻丝过程更加顺利，提高螺纹的质量。

14 A finishing cut, as opposed to a roughing cut, is done:

At a deeper depth of cut
At higher rpm
At a larger feed rate
At a smaller feed rate
At a shallower depth of cut
At lower rpm

At higher rpm
At a smaller feed rate
At a shallower depth of cut

15 Which are true about Lubricants for cutting?

They are comprised almost entirely of hydrocarbons with some additives.
They reduce the temperature of the cutting tool, but not as much as other cutting fluids.
They make it easier for cutting chips to not to stick to the cutting tool.
They make cutting surfaces smoother.

They should be used at lower cutting speeds than other types of cutting fluids.
They dissolve easily in water【】

@They are comprised almost entirely of hydrocarbons with some additives.
@They reduce the temperature of the cutting tool, but not as much as other cutting fluids.
@They make it easier for cutting chips to not to stick to the cutting tool.
@They make cutting surfaces smoother.
@They should be used at lower cutting speeds than other types of cutting fluids.
润滑剂在切削过程中的应用非常重要，它们可以显著影响切削性能和工件质量。以下是对您提供的选项的分析：

1. **They are comprised almost entirely of hydrocarbons with some additives.**（它们几乎完全由烃类和一些添加剂组成。） 这个说法是正确的。润滑剂通常由基础油（如矿物油或合成油）和各种添加剂组成，这些添加剂可以提高润滑剂的性能，如抗氧化性、抗磨损性等。
2. **They reduce the temperature of the cutting tool, but not as much as other cutting fluids.**（它们可以降低切削工具的温度，但不如其他切削液。） 这个说法也是正确的。润滑剂的主要功能之一是减少切削区域的温度，从而降低工具磨损。然而，与水基切削液相比，它们可能不会提供相同的冷却效果，因为水基切削液具有更高的热传导性。
3. **They make it easier for cutting chips to not to stick to the cutting tool.**（它们使切屑更容易不粘附在切削工具上。） 这个说法是正确的。润滑剂可以减少切屑与工具之间的摩擦，从而减少切屑粘附，这有助于提高切削效率和工具寿命。
4. **They make cutting surfaces smoother.**（它们使切削表面更光滑。） 这个说法是正确的。润滑剂可以减少切削过程中的摩擦，从而有助于获得更光滑的切削表面，提高工件的表面质量。
5. **They should be used at lower cutting speeds than other types of cutting fluids.**（它们应该在比其他类型的切削液更低的切削速度下使用。） 这个说法是正确的。由于润滑剂的冷却效果可能不如水基切削液，它们可能更适合在较低的切削速度下使用，以避免过热.
6. **They dissolve easily in water.**（它们容易溶解在水中。） 这个说法不正确。润滑剂通常不易溶于水，因为它们主要由烃类组成，而烃类是疏水的。水溶性是水基切削液的特性，而不是润滑剂的。

16 A new lathe insert is used on a 100 mm diameter steel workpart, with the lathe going at 300 rpm the insert lasts about 321 min, but at a 100 rpm it lasts for 2010 min. What material could you assume the lathe insert is made out of?

Ceramic
High Speed Steel
Some Refractory alloy
Cemented carbide

Ceramic

车削加工中，刀具材料的选择对加工效率和刀具寿命有重要影响。根据您提供的信息，我们可以分析出车刀片的可能材料：

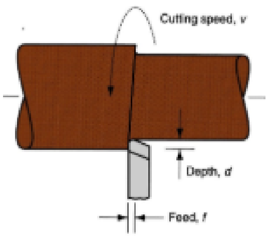
1. **Ceramic (陶瓷)**:

- 陶瓷刀具以其高硬度和耐磨性而闻名，在低速时磨损较少，这与您观察到的性能相符。陶瓷刀具在高速切削时能保持稳定性，但在低速时由于热量产生较少，磨损也相对较慢，这与您提供的数据相吻合，即在100 rpm时刀具寿命显著长于300 rpm时。

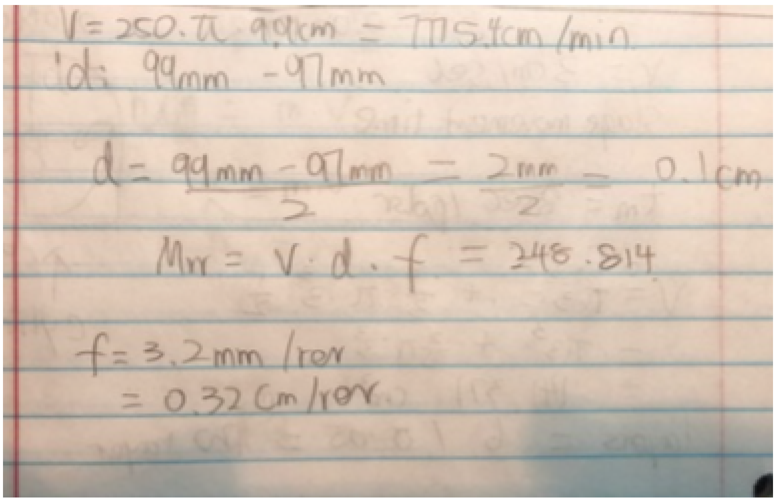
2. **High Speed Steel (高速钢)**:
   - 高速钢刀具在低速时由于热量产生较少，通常磨损更快，这与您提供的情况不符。高速钢更适合于需要韧性而非极端耐磨性的应用，且在低速时可能因热量不足而导致刀具寿命缩短。
3. **Some Refractory alloy (耐火合金)**:
   - 耐火合金是一个广泛的类别，可能有不同的性能特点，但它们通常不与所描述的磨损特性相关联。耐火合金通常用于极端环境下，如高温或腐蚀性环境，而不是基于切削速度变化的耐磨性。
4. **Cemented carbide (硬质合金)**:
   - 硬质合金耐用且硬度高，但不会像陶瓷那样对速度变化如此敏感。硬质合金在高速和低速下都表现出较好的耐磨性，但不会在速度降低时显著延长寿命，这与您提供的数据不符。

17 Material removal rate for lathe machining

A lathe rotating at 100 rpm is used to reduce the diameter of a 8 cm long section of stock metal rod from a diameter of 99 mm to 96 mm at a feed rate of 3.5 mm/rev. The force measured at the tool post was 3100 N down and 1900 N pulling the tool toward the workpart. What is the material removal rate (give answer to TWO decimal places)?



M_{RR} = 163 cm^3/min



$V = 250 \cdot \pi \cdot 9.9cm = 7775.4 cm/min$

$d: 99mm - 97mm$

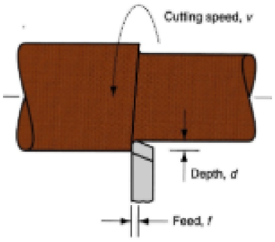
$d = \frac{99mm - 97mm}{2} = \frac{2mm}{2} = 0.1cm$

$M_{rr} = V \cdot d \cdot f = 248.814$

$f = 3.2mm/rev$
$= 0.32 cm/rev$

18 Cutting time for lathe machining

A Lathe rotating at 150 rpm is used to reduce the diameter of an 13 cm long section of stock metal rod from a diameter of 100 mm to 95 mm at a feed rate of 3.5 mm/rev. The force measured at the tool post was 3300 N down and 1900 N pulling the tool toward the workpart. How long does it take to cut the 13 cm length?



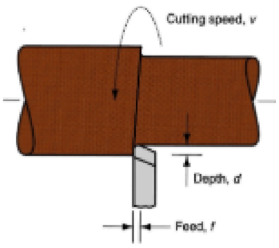
Time = 14.85 sec

$T = \frac{\pi \cdot D_o \cdot L}{f \cdot V} = \frac{\pi \cdot 10cm \cdot 8cm}{0.32cm \cdot (100 \cdot \pi \cdot 10cm)} = 0.25\ min$

$= 15s$

19 Specific energy calculation for lathe machining

A Lathe rotating at 150 rpm is used to reduce the diameter of an 10 cm long section of stock metal rod from a diameter of 100 mm to 98 mm at a feed rate of 3.4 mm/rev. The force measured at the tool post was 3200 N down and 1900 N pulling the tool toward the workpart. What is the specific energy of this material?



U = 0.941 J/mm^3

$F_{down} = F_c = 3300\ N$

$P_c = F_c \cdot V$

$V = 200\ rpm \cdot \pi \cdot 0.101\ m = 63.460\ m/min$

$P_c = 209418.5663\ N \cdot m/min$

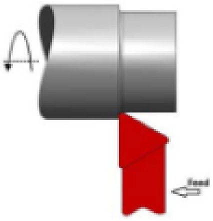
$M_{rr} = 63460.17 \cdot 3.5 \cdot \frac{101-95}{2} = 666337\ mm^3/min$

mm / mr

$U = \frac{P_c}{M_{rr}} = 0.314\ J/mm^3$

20 Turning operaion tool life

(5 pts) In a turning operation, an aluminum workpart is reduced from a radius of $26\mathrm{mm}$ to a radius of $24\mathrm{mm}$. If the lathe is set at $1500\mathrm{rpm}$ the tool edge lasts just long enough to cut $50\mathrm{parts}$ taking $4\mathrm{minutes}$ for each. If the lathe is slowed to $1/3\mathrm{rd}$ that speed ($500\mathrm{rpm}$) the tool can now make it through an amazing $1400\mathrm{parts}$, but it takes $3\mathrm{times}$ longer per part. If you then ran the lathe at $1000\mathrm{rpm}$ how many parts could you make before having to replace the cutting edge?



Number of Parts = 170 **rounded down**

1500 rpm $T_1 = 50 \cdot 4min = 200min$

$V_1 = 122522.1135$

500 rpm $T_2 = 4min \cdot 3 \cdot 1400 = 16800 min$

$V_2 = 40840.7045$ mm/min

$122522 \cdot 200^n = 40840.7045 \cdot 16800^n$

$$\frac{122522}{40840.7045} = \left(\frac{16800}{200}\right)^n$$

$n = 0.248$

1500 rpm $T_1 = 50 \cdot 4min = 200min$

rev/part = 4min · 1500 = 6000 rev/part

500 rpm t per part = 12min

rev/part = 12min · 500 = 6000 rev/part

$C = 122522 \cdot 200^{0.248} = 455899.92$

1000 rpm $V = 81681.409$ mm/min

$81681.409 \cdot T^{0.248} = 455899.92$

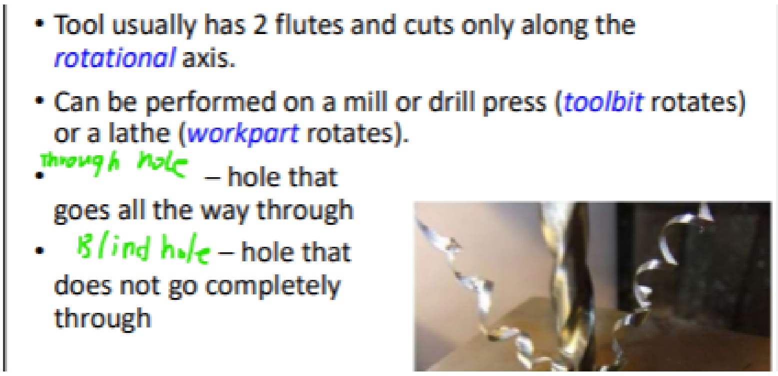
total rev = 1025826.14 $T = \left(\frac{455899.92}{81681.409}\right)^{\frac{1}{0.248}}$

parts = 170 $T = 1025.826$ min

21 How is a blind hole defined in a drilling operation?

A hole that can be drilled at any location on the face of the workpiece
A hole that does not go all the way through to the other side of the workpiece
A hole that can be made to any depth
A hole that must be drilled when the operator's view of the drill bit is obstructed

A hole that does not go all the way through to the other side of the workpiece



22 When creating inside corners on milled and turned parts, chamfered and sharp edges are preferred over fillet radii.

False

1. **锋利边（Sharp Edges）**：
    - 锋利的边缘通常是在材料从一种截面突然过渡到另一种截面时形成的，例如在铣削或车削过程中形成的内角。锋利的边缘可能会导致应力集中，这在某些应用中可能不利于工件的强度和耐用性。
2. **倒角（Chamfered Edges）**：
    - 倒角是将锋利的边缘或角落加工成斜面，以减少或消除锐角。倒角可以改善工件的外观，减少装配时的磨损，并在一定程度上减少应力集中。
3. **圆角半径（Fillet Radii）**：
    - 圆角半径是在两个表面或边缘之间创建一个平滑过渡的圆角。与锋利边和倒角相比，圆角可以更有效地减少应力集中，提高工件的强度和耐用性。在许多结构和工程应用中，圆角半径是首选，因为它们可以提高整体的机械性能。

例如，在需要承受高负载或经常受到冲击的应用中，圆角半径可能是更好的选择，因为它们可以减少应力集中，提高零件的寿命。而在某些只需要简单去毛刺或者外观不是主要考虑因素的应用中，可能会选择倒角或锋利边。

在铣削和车削零件的内部角落创建时，圆角半径（fillet radii）通常比倒角（chamfered）和锐边（sharp edges）更受青睐。这是因为圆角半径（fillet radii）在多个方面具有优势：

23 When calculating useful tool life, there is a linear relationship between cutting speed and tool life.

False

指数

24 It is easier and less expensive to chamfer outside corners compared to adding a radius or round:

True
，倒角（chamfer）比加圆角（radius）或倒圆（round）更容易且成本更低。

25 If you must use a 1/4 inch diameter mill, then the best surface tolerance and finish would be gotten if all inside vertical corners had a fillet radius with the minimum requirement of:

(a) < 0.25 inch
(b) < 0.125 inch
(c) = 0.125 inch
(d) = 0.25 inch
(e) > 0.25 inch
(f) > 0.125 inch

(f) > 0.125 inch
1/4英寸直径铣刀加工的情况 1/8

26 CNC tool life and machining costs

(5 pts) The operator of a CNC machine gets paid **$60/hr** . It takes him **8min** to load and unload a part (i.e. handling time), and **6 min** to change the cutting tool (which has Taylor coefficients of and. When he runs the spindle at **900rpm** it finishes a part in **11min** . His cutting tool costs him **$95** each and he is able to machine **80 parts** before having to replace the tool. He wants to know if he can save money by running the spindle at **1100rpm**.
What is the cost per part at and at ?
Cost per part at 900 rpm = $__
Cost per part at new rpm = $____

(5 pts) The operator of a CNC machine gets paid $\$60/\mathrm{hour}$. It takes him $8\ \mathrm{min}$ to load and unload a part (i.e. handling time), and $4\ \mathrm{min}$ to change the cutting tool (which has Taylor coefficients of 0.25 and $900\ \mathrm{m/min}$). When he runs the spindle at $900\ \mathrm{rpm}$ it finishes a part in $11\ \mathrm{min}$. His cutting tool costs him $\$95$ each and he is able to machine 80 parts before having to replace the tool. He wants to know if he can save money by running the spindle at $1300\ \mathrm{rpm}$.

What is the cost per part at $900\ \mathrm{rpm}$ and at $1300\ \mathrm{rpm}$?

$$C = vT^n \rightarrow \frac{T_2}{T_1} = \frac{(C/v_2)^{1/n}}{(C/v_1)^{1/n}} = \left(\frac{v_1}{v_2}\right)^{1/n}$$

Cost per part at $900\ \mathrm{rpm}$ = \$ 20.2375 dollars,

Cost per part at new rpm = \$ 19.348 dollars, Paid: \$60 / hour \$1 / min

$T_h = 8$ min / part $T_t = 6$ min

$T_{m_{900}} = 11$ min

$$T_{c_{900}} = 8\text{min} \cdot \$1 + 11 \cdot \$1 + \$1 \cdot \frac{6\text{min}}{80} + \frac{\$95}{80}$$

$$\boxed{= \$20.2625}$$

rev / part $= 900 \cdot 11\text{min} = 9900$ rev / part

$T_1 = 11 \cdot 80 = 880$ min

$$T_2 = T \cdot \left(\frac{V_1}{V_2}\right)^{1/n}$$

$$T_2 = 880 \left(\frac{900}{1100}\right)^{1/0.25}$$

$= 394.35$ min

Total rev $= 433785.124$ rev

parts $= 43.817$ parts

Time / part $= 9$ min / part

$$T_{c_{1100}} = 8 \cdot 1 + 9 \cdot 1 + 1 \cdot 6/43 + \$95/43$$

$$\boxed{T_{c_{1100}} = \$19.349}$$