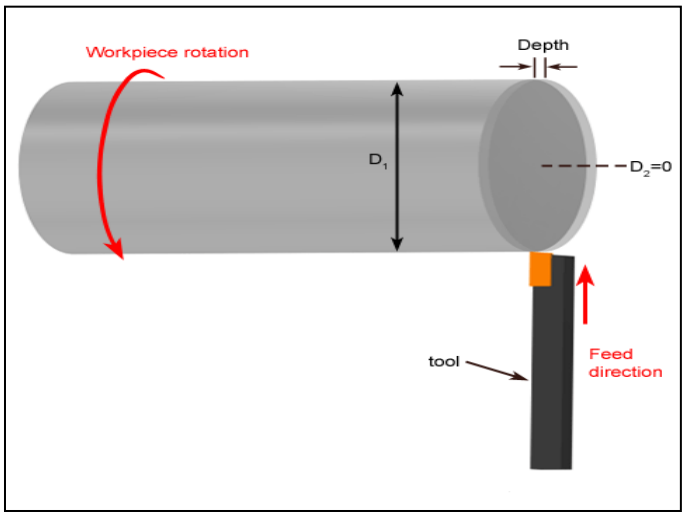
Perform facing operation on MS rod to calculate machining time and Material removal rate (MRR).

Apparatus:

Lathe machine, stop watch, tachometer, MS rod.

Figure:



Theory

Facing operation

Facing is the process of removing metal from the end of a workpiece to produce a flat surface. Most often, the workpiece is cylindrical, but using a 4-jaw chuck you can face rectangular or odd-shaped work to form cubes and other non-cylindrical shapes.

FORCE RELATIONSHIPS

Several forces can be defined relative to the orthogonal cutting model. Based on these forces, shear stress, coefficient of friction, and certain other relationships can be defined. Consider the forces acting on the chip during orthogonal cutting in Figure .

The forces applied against the chip by the tool can be separated into two mutually perpendicular components: friction force and normal force to friction. The friction force F is the frictional force resisting the flow of the chip along the rake face of the tool. The normal force to friction is perpendicular to the friction force. These two components can be used to define the coefficient of friction between the tool and the chip

$$\mu = \frac{F}{N}$$

The friction force and its normal force can be added vectorially to form a resultant force R, which is oriented at an angle b, called the friction angle. The friction angle is related to the coefficient of friction as

$$\mu = \tan \beta$$

In addition to the tool forces acting on the chip, there are two force components applied by the workpiece on the chip: shear force and normal force to shear. The sheer force Fs is the force that causes shear deformation to occur in the shear plane, and the normal force to shear Fn is perpendicular to the shear force. Based on the sheer force, we can define the shear stress that acts along the shear plane between the work and the chip:

$$\tau = \frac{F_s}{A_s}$$

where As= area of the shear plane. This shear plane area can be calculated as

$$A_s = \frac{t_o w}{\sin \phi}$$

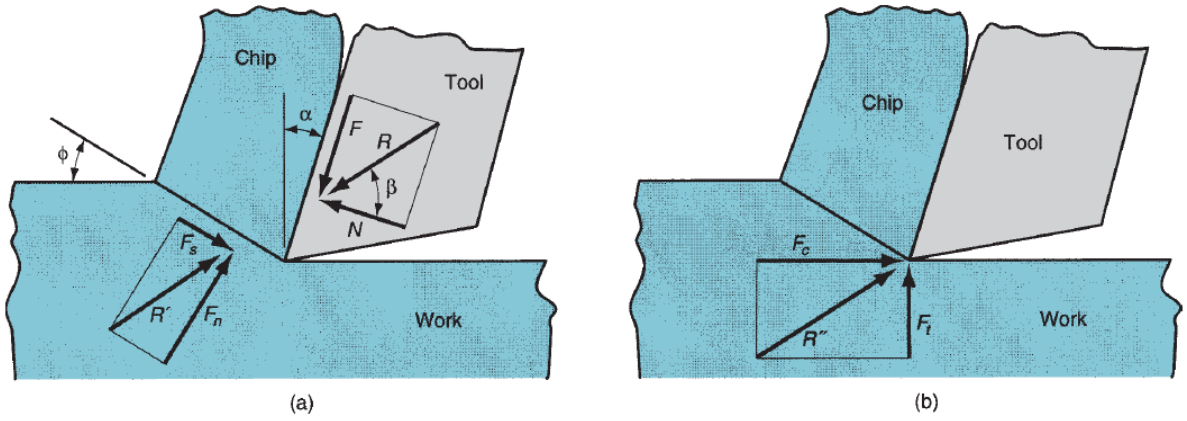


Fig: (a) Forces acting on the chip in orthogonal cutting (b) Forces acting on the tool that can be measured

Cutting Parameters for Facing Operation

Cutting speed

The rotational speed in turning is related to the desired cutting speed at the surface of the Cylindrical workpiece by the equation

$$N = \frac{v}{\pi D_o}$$

Where N =rotational speed, rev/min; v=cutting speed, m/min (ft/min); and Do=original diameter of the part, m (ft).

Depth Of Cut

The turning operation reduces the Length of the work from its original length Li to a final Length L_f, as determined by the depth of cut d.

$$d=\frac{Li-Lf}{N}$$

N= Number of passes

Feed/Feed Rate

The feed in facing is generally expressed in mm/rev (in/rev). This feed can be converted to a linear travel rate in mm/min (in/min) by the formula

$$f_r = Nf$$

where fr=feed rate, mm/min (in/min); and f =feed, mm/rev (in/rev)

Machining Time

The time to machine from one end of a cylindrical workpart to the other is given by

$$T_M=\frac{D}{2xFxRPM}xN$$

D=Diameter of workpiece
F=feed
N = Number of passes

Procedure

- Give a complete rotation to cross slide and note time
- Calculate feed rate and place workpiece in chuck
- Give 5 lines depth of cut to carriage and feed to cross slide
- Note time for actual machining

Observations & Calculations:

Number of passes=N=

Feed Rate=F_r=---------- (mm\mint)

Sr. No	Diameter of rod D	Initial Length of rod Li	Final Length of rod Lf	Depth of cut=t= $\frac{Li-Lf}{N}$	RPMs	Cutting Speed $V_i=\pi DixRPM$	Feed F=F_r\RPM	Machining Time $T_M=\frac{D}{2xFxRPM}xN$	Actual Machining time	MRR = π xDxtxFr
	mm	mm	mm	mm	rev/min	mm\mint	mm\rev	mint	mint	mm\mint
1										
2										
3										
4										
5										

Graphs:

1. Plot a relationship between RPMs and Cutting Speed.
2. Plot a relationship between RPMs and Feed.
3. Plot a relationship between RPMs and Machining Time.
4. Plot a relationship between RPMs and Actual Machining Time.
5. Plot a relationship between Machining Time and Actual Machining Time.
6. Plot a relationship between RPMs and Material Removal Rate.

Calculations:

Questions

What is difference between rake angle and clearance angle?

Why rake angle is negative some time?

What are different materials used for single point cutting tools?

What is tool angle for facing operation?

Comments on

How to increase material removal rate?