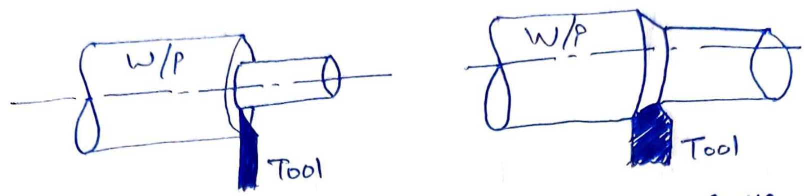
23MAT203 - Production Technology (5th Sem)

Unit-1: Theory of Metal Cutting

1. Orthogonal and Oblique cutting



(a) Orthogonal Cutting (b) Oblique Cutting

Cutting processes remove material from the surface of a workpiece by producing chips.

(a) Orthogonal Cutting (2D Cutting)

→ Cutting edge of tool ⊥r to cutting velocity

→ It involves 2 forces & makes analysis simpler.

(b) Oblique Cutting (3D cutting)

→ Cutting edge is inclined at an angle normal to the cutting velocity.

→ The analysis is more complex.

	Orthogonal Cutting	Oblique Cutting
1.	Cutting edge ⊥r to cutting velocity vector.	Cutting edge inclined at an angle normal to cutting velocity vector.
2.	Chip flows over the tool face and direction of chip flow velocity is normal to cutting edge.	Chip flow on tool face making an angle normal to cutting force.
3.	Cutting edge clears w/p width on either end (i.e., no side flow)	It may or may not clear width of w/p.
4.	Max. chip thickness occurs in the middle.	Max. chip thickness may not occur in the middle.
5.	Tool life is less.	Tool life is more.
6.	Tool perfectly sharp & contacts chip on rake face only.	Mostly more than 1 cutting edges are in action.

7. Poor surface finish	Better Surface finish.
8. It is also known as 2D cutting because the force developed during cutting can be plotted on 2D coordinate.	It is also known as 3D cutting because the cutting force developed during cannot be represented in 2D coordinates, but only with 3D coordinates.
9. High heat concentration @cutting region.	Less heat concentration @cutting region than ortho. cutting method.
10. Eg.: Parting, grooving, slotting, pipe cutting	Eg.: Almost all industrial cutting, drilling, milling & grinding

2. Classification of cutting tools: Single and Multipoint:

Cutting tool or a cutter is typically a hardened metal that is used to cut, shape and removal of material from a workpiece by means of a machine tools as well as abrasive tools by way of shear deformation.

Classification → Single point cutting tool
→ Multipoint cutting tool.

Single point cutting Tool:

→ These tools contain only one main cutting edge in the cutter body.

→ These tools are used for turning, boring, shaping or planing operations and used on lathe, boring and shaper machines.

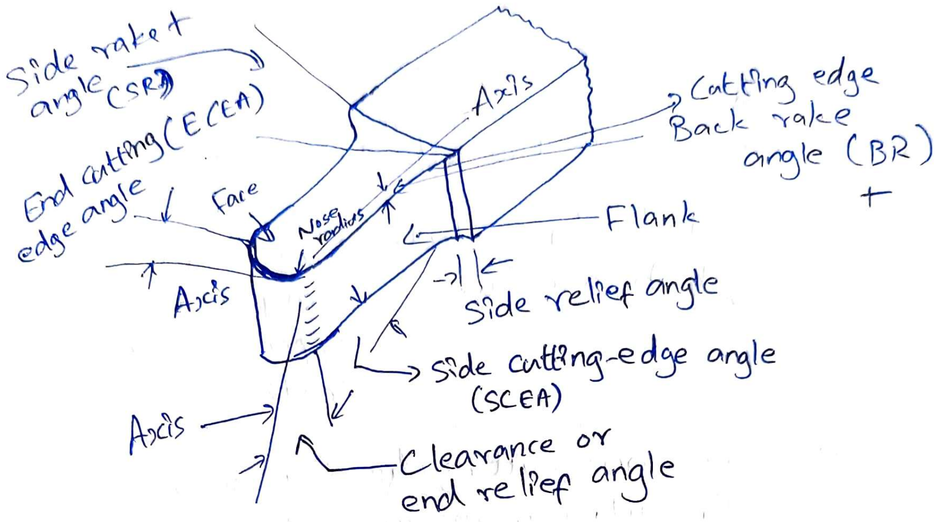
→ A single point cutting tool consists of sharpened cutting part / operating end called as point and shank / body.

→ Point of tool is bound by Face, side / major flank, end / mirror flank & base.

→ Side / major cutting edge is formed by intersection of face & side flank.

→ Chips are cut from w/p by side cutting edges.

→ The point where the end and side cutting edges meet is called nose.



* Shank - Main body of tool
* Flank - Surface below & adjacent to cutting edge is flank of tool.
* Face - Surface on which chip slides is called Face of tool.
* Nose - Formed at junction of side & end cutting edges. This junction / nose has a curve of small radius, known as nose radius.
* Cutting edge - It is the edge on the face of the tool which removes the material from the w/p. The cutting edge consists of the side cutting edge (major cutting edge) and cutting edge (minor cutting edge) and the nose.

	Single pt Cutting Tool	Multipoint cutting tool
1.	It has only one main cutting edge in the cutter body.	It has more than one cutting edges in the cutter body.
2.	While machining, only one main cutting edge continuously remains in contact with the w/p.	While machining, more than one cutting edges simultaneously engage in material removal action in a pass.
3.	Chip load per tooth is high, usually.	Due to presence of multiple cutting edges, effective chip load per tooth reduces.
4.	Since one cutting edge continuously remains in contact with the w/p, tool temperature subsequently increases.	Due to the successive engagement and disengagement, heat dissipates when the cutter is not in contact with w/p. So, rise of tool temperature is low.
5.	If the cutting edge breaks, the entire process must be paused until the broken tool is replaced by a new one.	If one cutting edge breaks, cutting action can be continued with other edges without much problem.
6.	Design and fabrication are easier	Design and fabrication is quite difficult.
7.	Low feed rate and depth of cut	High feed rate
8.	Low productivity and material removal rate.	High productivity and material removal rate.
9.	Eg.: Turning, Boring, Slotting	Eg: Reamer, Grinding, Milling.