Machining and Machine Tool Operations

Theory of Metal Cutting

The material removal processes are family of shaping operations in which excess material is removed from a starting work part so that what remains is the desired final geometry.

Machining

Machining is a manufacturing process in which a sharp cutting tool is used to cut away material to leave the desired part shape. The predominant cutting action in machining involves shear deformation of the work material to form a chip; as chip is removed, a new surface is exposed.

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The process of removing metal can be done by using two types of cutting tools.

- Single Point cutting tools
  - Ground type
  - Tilled type
- Multipoint Cutting tools
  - Drill bit
  - Milling cutter
  - Grinding wheel, etc.

MRR obtained from multipoint cutting tool is more than that from single point cutting tool. The life of multipoint cutting tool is more than single point cutting tool. Single point cutting tools are fed axially at a uniform feed per revolution. But multipoint cutting tools are fed perpendicularly to the cutter axis of rotation.

Methods of machining

- Orthogonal Cutting or 2D cutting
- Oblique cutting or 3D cutting

Advantages of Machining

- Variety of work materials
- Variety of part shapes and geometric features.
- Dimensional accuracy
- Good surface finishes

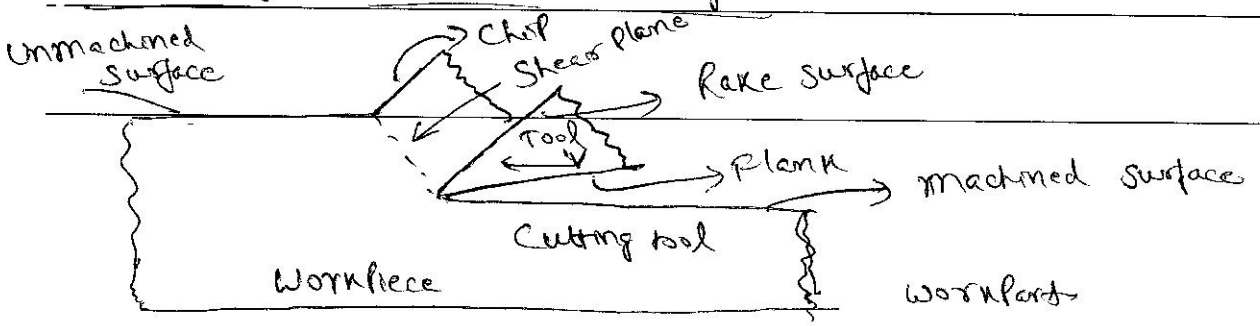
Limitations:

- Wastage of material
- Time consuming

Drawback in Machining

- Loss of material in the form of chips.

Orthogonal metal cutting



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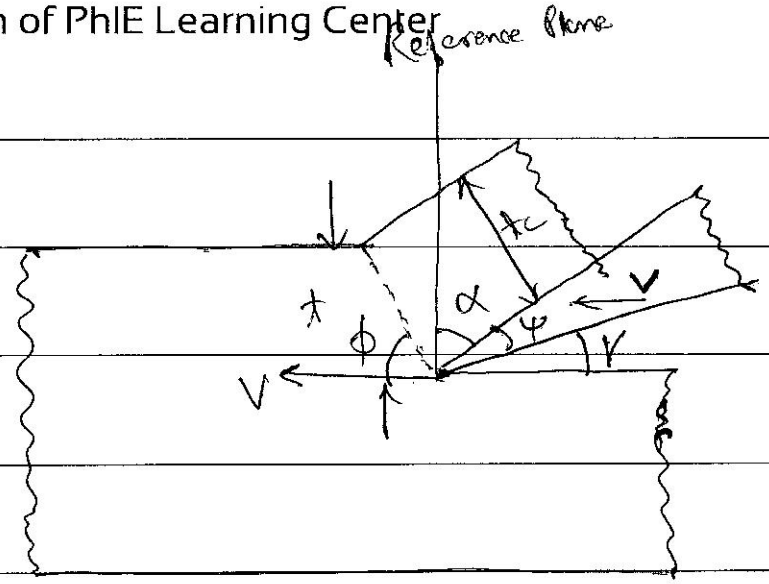

$\alpha \rightarrow$ ~~Ortog~~ Orthogonal rake angle

$\gamma \rightarrow$ Clearance angle or relief angle

$\phi \rightarrow$ Shear angle

ψ = Lip angle or Knife angle or wedge angle or cutting angle

t = Uncut chip thickness or Undeformed chip thickness

= d (depth of cut)

$\Rightarrow t = d$ [In orthogonal c

In turning

$t = f \sin\lambda$, $\lambda \rightarrow$ Principal cutting edge angle

$f \rightarrow$ feed rate