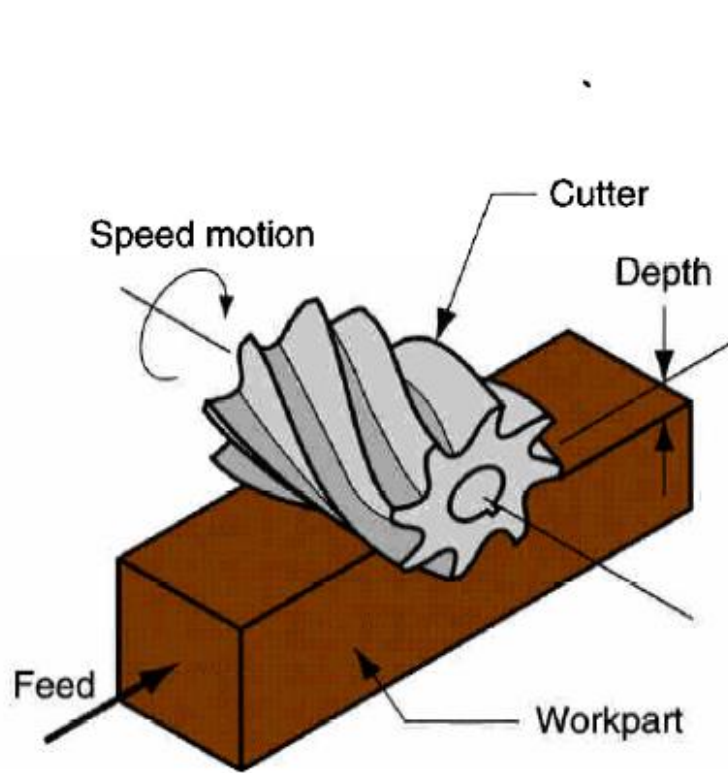


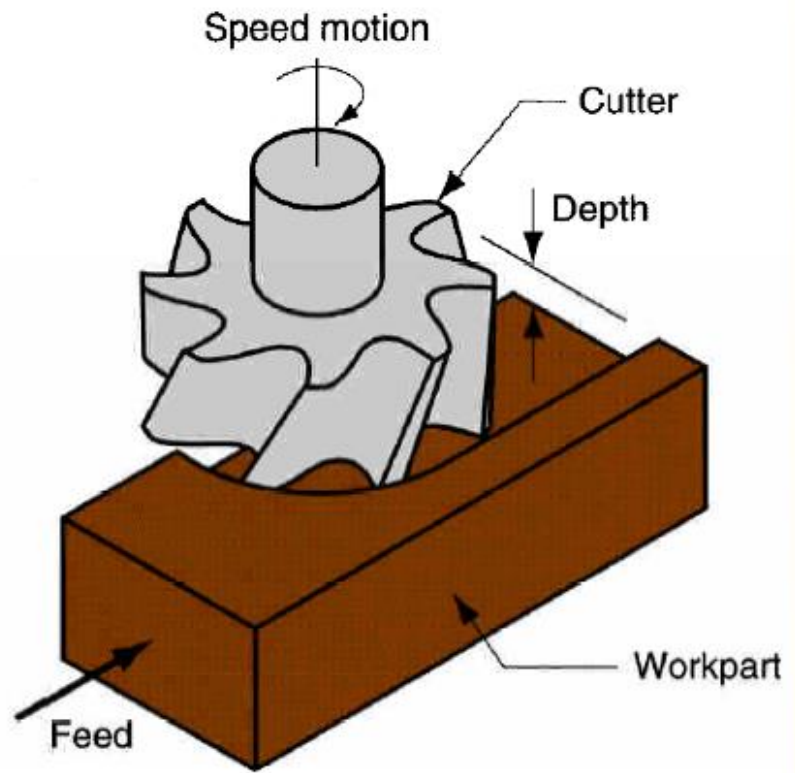
Milling

Machining operation in which work is fed past a rotating tool with multiple cutting edges

- Axis of tool rotation is perpendicular to feed direction
- Creates a planar surface; other geometries possible either by cutter path or shape
- Other factors and terms:
 - Milling is an *interrupted cutting* operation
 - Cutting tool called a *milling cutter*, cutting edges called "teeth"
 - Machine tool called a *milling machine*



(a)



(b)

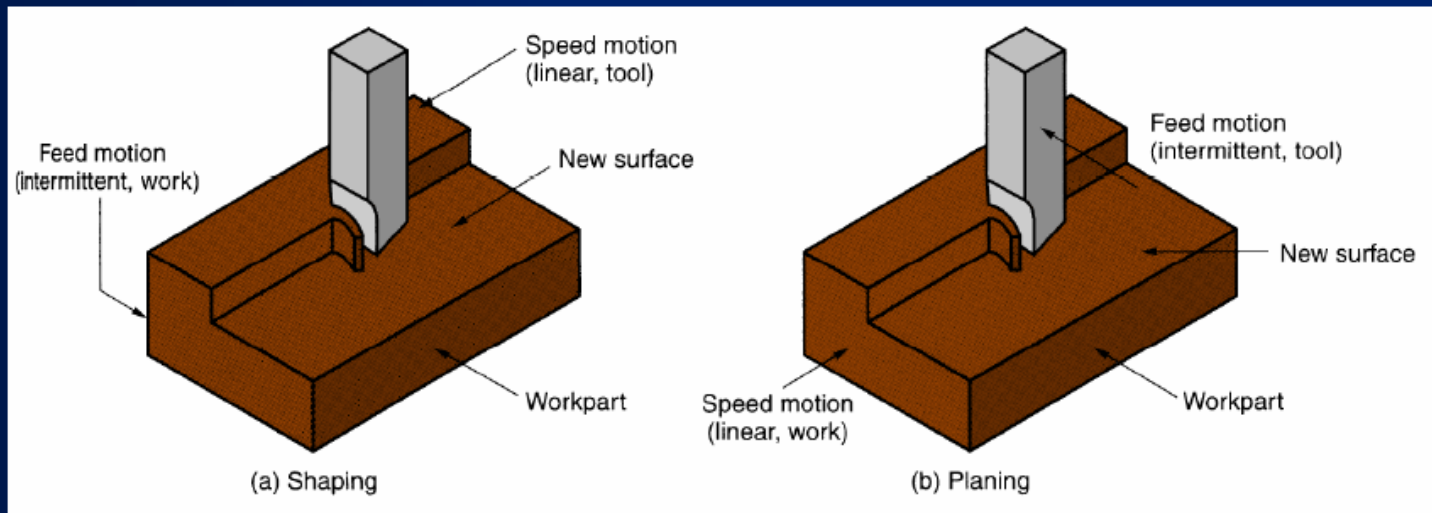
Two forms of milling:
(a) peripheral milling, and (b) face milling

Peripheral Milling vs. Face Milling

- Peripheral milling
 - Cutter axis is parallel to surface being machined
 - Cutting edges on outside periphery of cutter
- Face milling
 - Cutter axis is perpendicular to surface being milled
 - Cutting edges on both the end and outside periphery of the cutter

Shaping and Planing

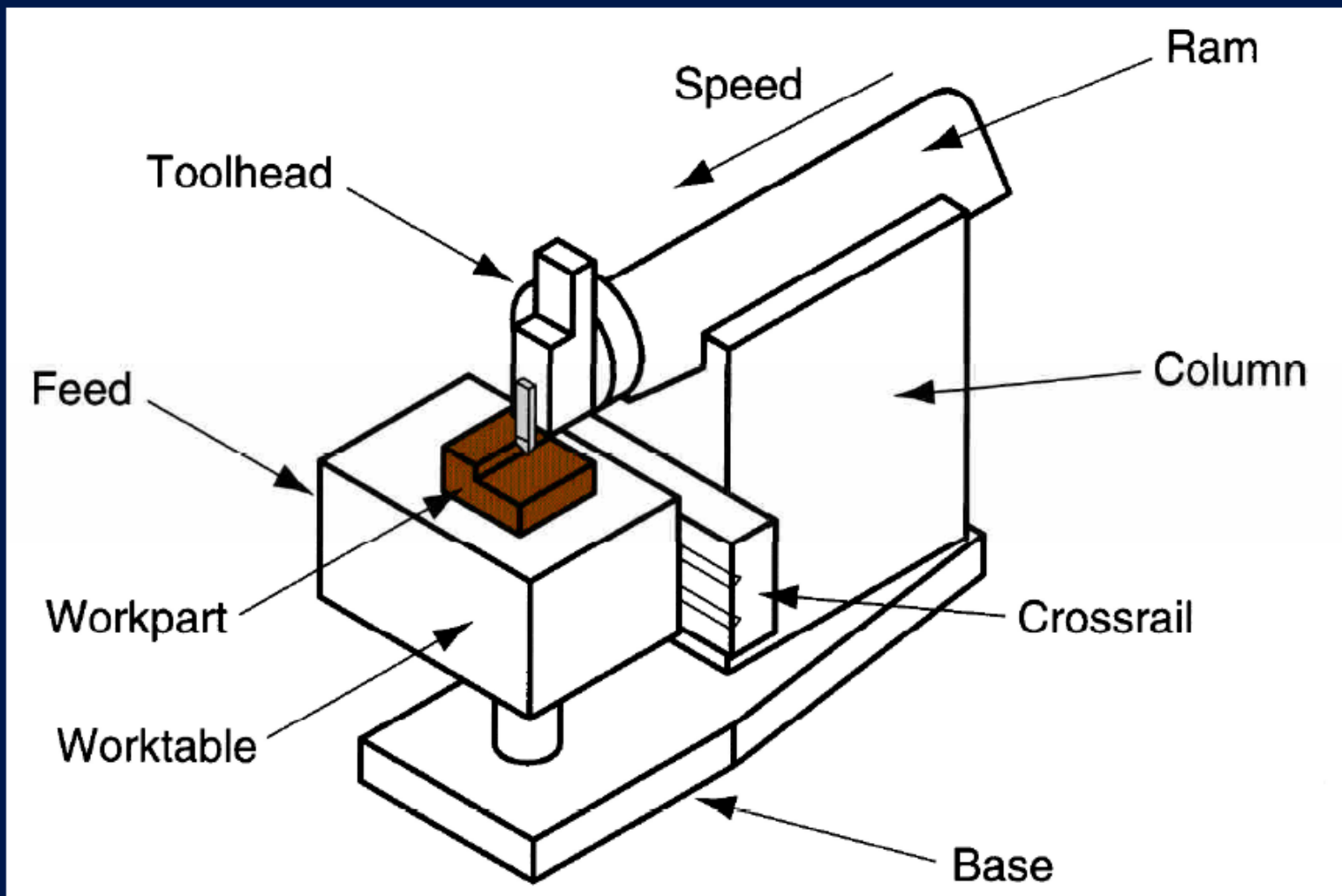
- Similar operations
- Both use a single point cutting tool moved linearly relative to the workpart



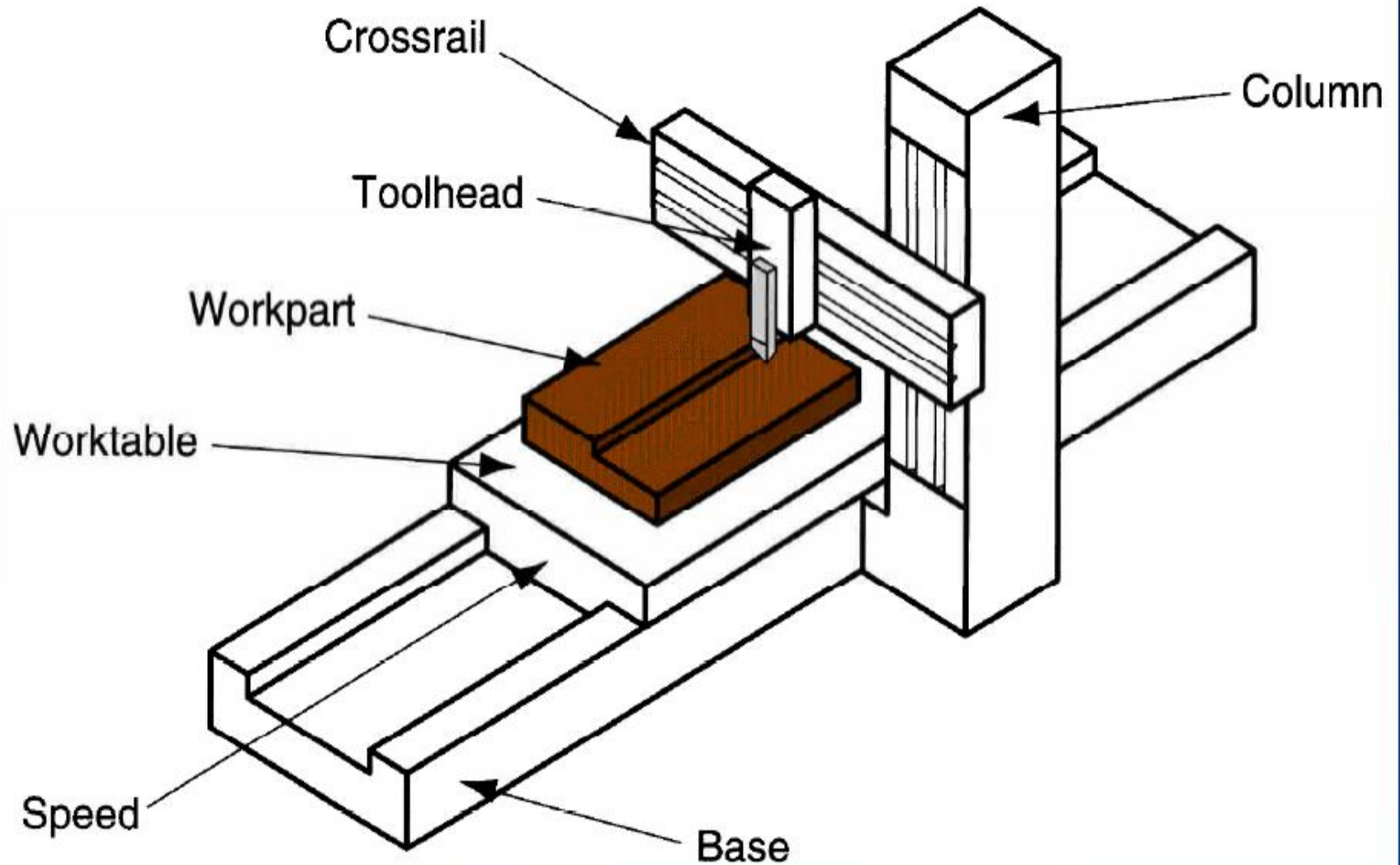
(a) Shaping, and (b) planing

Shaping and Planing

- A straight, flat surface is created in both operations
- Interrupted cutting
 - Subjects tool to impact loading when entering work
- Low cutting speeds due to start-and-stop motion
- Usual tooling: single point high speed steel tools



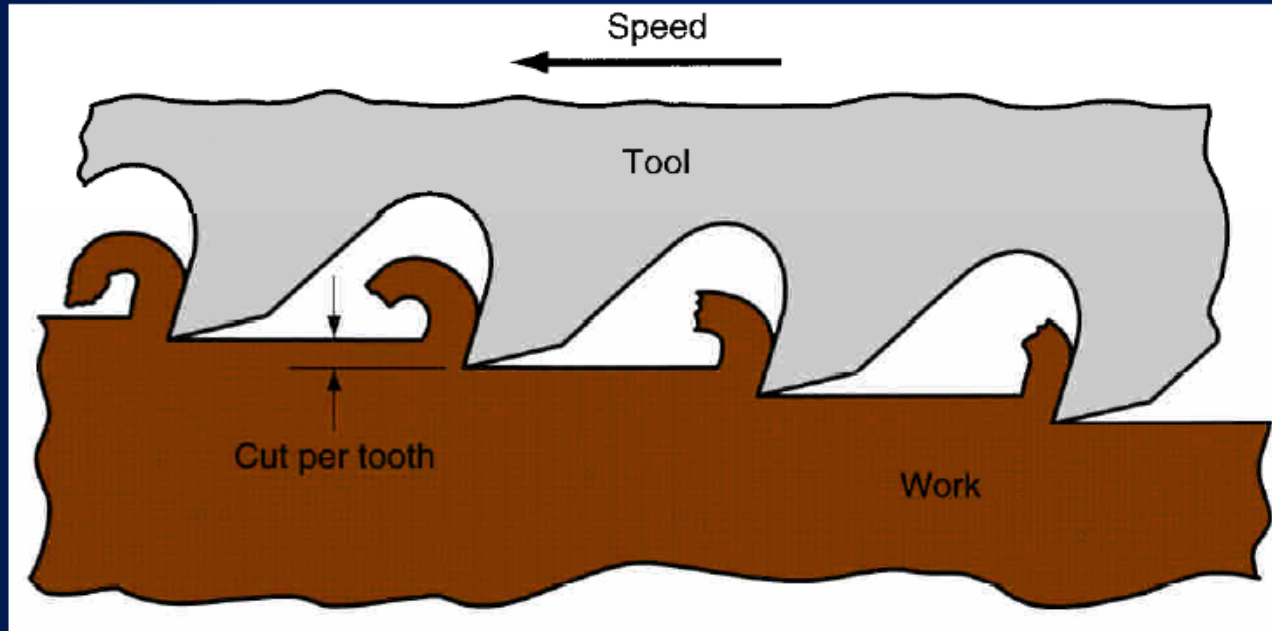
- Components of a shaper



- Open side planer

Broaching

- Moves a multiple tooth cutting tool linearly relative to work in direction of tool axis



- The broaching operation

Broaching

Advantages:

- Good surface finish
- Close tolerances
- Variety of work shapes possible

Cutting tool called a *broach*

- Owing to complicated and often custom-shaped geometry, tooling is expensive