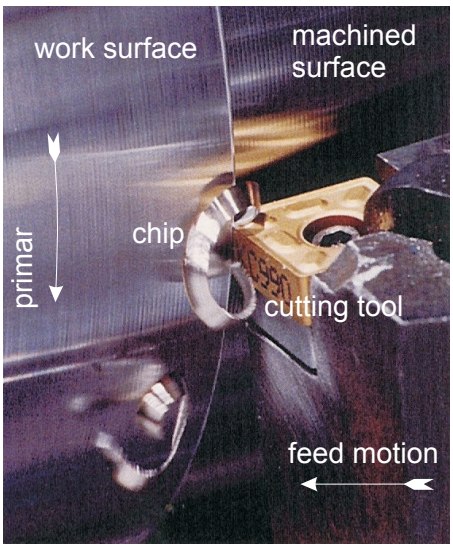
5 FUNDAMENTALS OF METAL CUTTING

CHAPTER CONTENTS

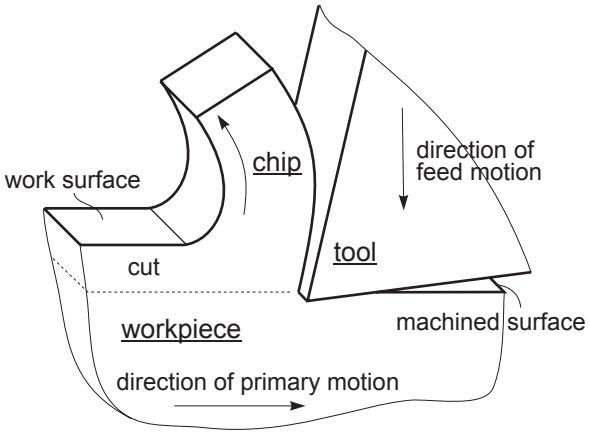
5.1 OVERVIEW OF MACHINING

Definitions

- *Machining*: term applied to all material-removal processes
- *Metal cutting*: the process in which a thin layer of excess metal (*chip*) is removed by a wedge-shaped single-point or multipoint *cutting tool* with defined geometry from a *workpiece*, through a process of extensive plastic deformation

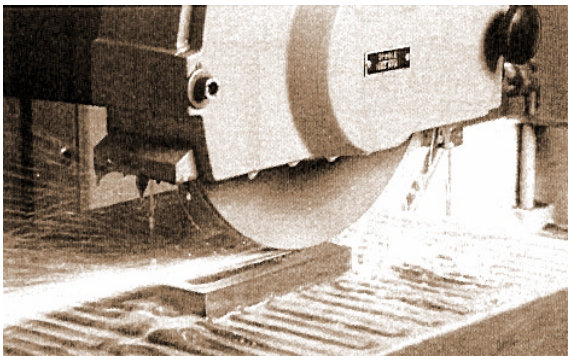


Close-up view of a turning operation in which a thin layer of metal (*chip*) is removed from the *work surface* of a rotating workpiece by a coated cemented carbide cutting tool. The newly generated surface is referred to as a *machined surface*. Cutting process requires both *primary* and *feed* motions.



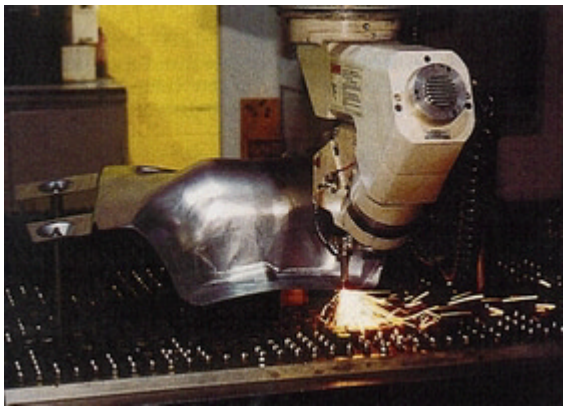
Schematics of metal cutting process showing the basic terminology.

❖ *Abrasive processes:* material removal by the action of hard, abrasive particles that are usually in the form of a *bonded wheel*. Each single particle acts like a single-point cutting tool. Since the particular geometry of a particle is not known, abrasive processes are referred to as *machining with geometrically undefined tools*



Set-up of the grinding operation showing the workpiece, abrasive bonded wheel and the spray of burned chips

❖ *Non-traditional processes*: machining with electrical, optical or chemical sources of energy



Cutting operation performed by a five-axis CO_2 laser

The place of machining operations

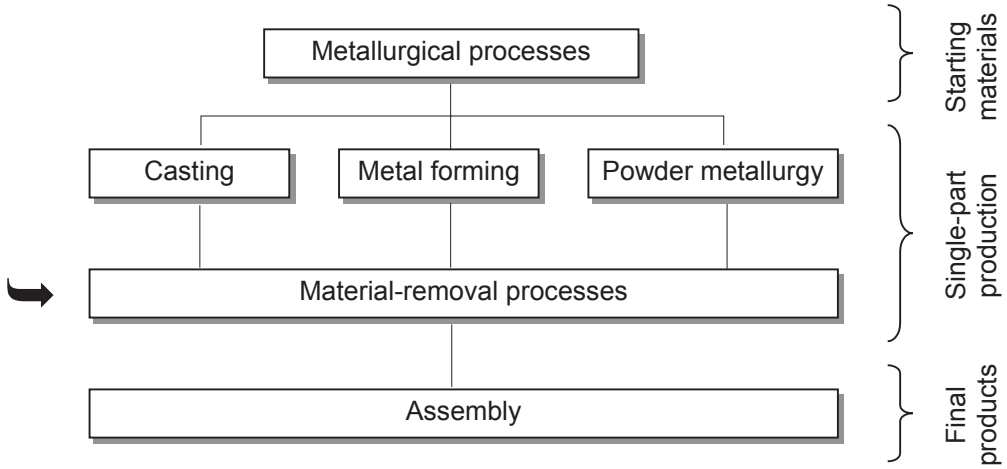


Diagram showing the place of machining operations within the entire production cycle.

Machining operations are capable of producing more precise dimensions and smooth surface finishes than all other manufacturing processes. They are performed after other processes, which create the general shape of the parts. Machining then provides the final geometry, dimensions and finish.