Description

Process schematic

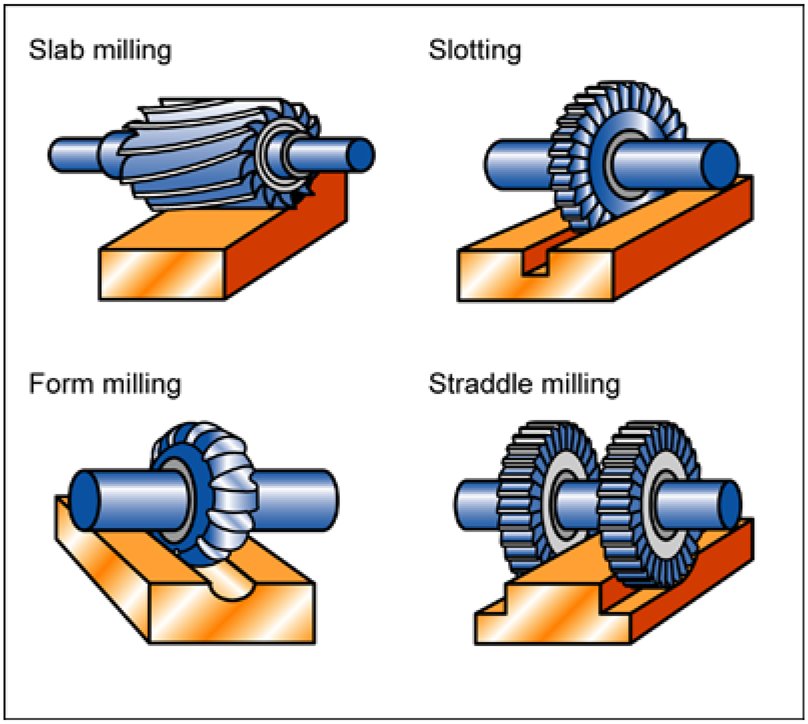

Figure caption

Milling techniques.

The process

In MILLING metal is removed by a rotating multiple-tooth cutter; each tooth removes a small amount of metal with each revolution of the spindle. Because both workpiece and cutter can be moved in more than one direction at the same time, surfaces having almost any orientation can be machined.

Material compatibility

Composites	✓
Metals - ferrous	✓
Metals - non-ferrous	✓
Polymers - thermoplastics	✓
Polymers - thermosets	✓

Shape

Circular prismatic	✓
Non-circular prismatic	✓
Flat sheet	✓
Dished sheet	✓
Solid 3-D	✓

Economic compatibility

Relative tooling cost	low

Relative equipment cost	high			
Labor intensity	medium			
Economic batch size (units)	1	-	1e7	

Physical and quality attributes

Mass range	0.0022	-	2.2e3	lb
Range of section thickness	7.87	-	1.97e4	mil
Tolerance	0.787	-	19.7	mil
Roughness	0.0394	-	0.984	mil
Surface roughness (A=v. smooth)	B			

Process characteristics

Machining processes	✓
Discrete	✓
Prototyping	✓

Supporting information

Design guidelines

All polymers and all but the hardest metals can be machined by milling. Ceramics and glasses can be drilled and cut, but require diamond or carbide-tipped tools. Very intricate shapes, high precision and finish are possible, but at a cost.

Typical uses

The profiling of metals with hardness below Rockwell 45 Rc, and some plastics and

The economics

Any production quantity is economic. Equipment varies from manual millers for small quantities to multiple-spindle numerically controlled systems for very high production levels.

The environment

Lubricants and cutting fluids can pose an environmental problem. Special precautions are essential when machining composites because of glass or carbon dust, and when machining toxic materials such as beryllium

Links

MaterialUniverse
Reference