# Milling

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# **Introduction**

• Addition to producing various external or internal round profiles, cutting operations can produce many other parts with more complex shapes



Fig:Typical parts and shapes produced with the machining process

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- Highly versatile machining operation
- Multitooth tool that produces a number of chips in one revolution



Fig:Some of the basic type milling cutters and milling operations.

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# Example of a part produces in a CNC

# *milling machine*



Fig : A typical part that can be produced on a milling machine equipped with computer controls.Such parts can be made efficiently and respectively on computer numerical control (CNC) machines, without the need for refixturing or reclamping the part

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**Slab Milling** 

- Slab milling also called as peripheral milling
- Cutters have straight or helical teeth resulting in orthogonal or oblique cutting action



Fig : (a) Conventional milling and climb milling (b) Slab milling operation, showing depth of cut, *d*, feed per tooth, *f*, chip depth of cut, *t*c, and workpiece speed, *v*. (c) cutter travel distance *l*c to reach full depth of cut.

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• The cutter is mounted on a spindle having an axis of rotation perpendicular to the workpiece surface.



Fig:A face milling cutter with indexable inserts.

(b) (a) Insert (c) (d)

Machined surface

Fig : Face milling operation showing (a) action of an insert in face milling; (b) climb milling; (c) conventional milling d)dimensions in face milling. The width of cut, w, is not necessarily the same as the cutter radius

## Face milling cutter



Fig:Terminology for a face milling cutter

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# **Cutters for different types of Milling**

(a) Straddle milling



(b) Form milling



(c) Slotting

(d) Slitting





Fig : Cutters for (a) Straddle Milling, (b) form milling, (c) slotting, and (d) slitting with a milling cutter.

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# **Other Milling Operations and Cutters**



Fig : (a) T-slot cutting with a milling cutter. (b) A shell mill.

## <u>Arbors</u>



Fig : Mounting a milling cutter on an arbor for use on a horizontal milling machine.

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# <u>Horizontal and Vertical Spindle Column</u> and Knee type Milling Machines



Fig : Schematic illustration of a horizontal-spindle column-and-knee type milling machine.



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## **Bed Type Milling Machine**

![](_page_11_Picture_1.jpeg)

Fig : Schematic illustration of a bed-type milling machine. Note the single vertical-spindle cutter and two horizontal-spindle cutters.

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