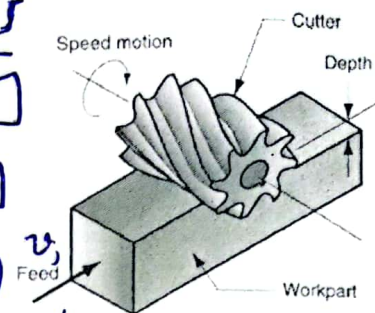


Milling Mechanics Summary - P1

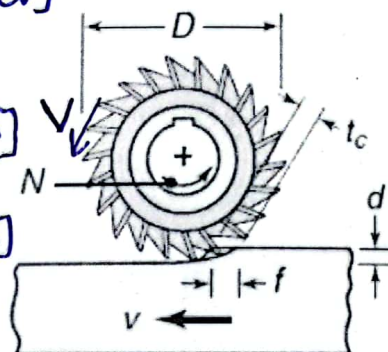
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1- Peripheral/Horizontal Milling

Symbol	Def ⁿ /Formula	Units
D	Cutter Diameter	[mm]
d	Depth of cut	[mm]
w	width of cut	[mm]
f	feed per tooth	[mm/tooth]
(or) $\frac{1}{3}$ - n	# of teeth on cutter	[teeth/rev]
F	feed per revolution (= f · n)	[mm/rev]
N	Cutter rotational speed (or spindle speed)	[rev/min]



(or f_r) v — linear speed of workpiece — [mm/min]
(or feed rate)
 $= f \cdot N \cdot n$



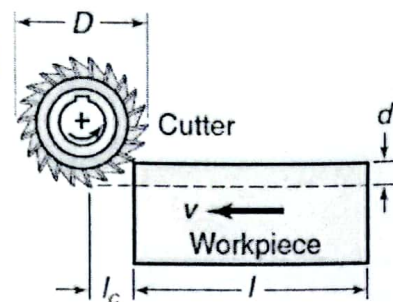
V — surface speed of the cutter — [m/min]
 $= \pi D N$

(or) l — length of cut — [mm]
(full length = 1 pass)

(or) l_c — horizontal (clearance) distance that cutter travels to reach full depth of cut — [mm]

$$= \sqrt{d(D-d)}$$

(for $D \gg d$, you can approximate $l_c = \sqrt{dD}$)



(or) t_m — cutting (machining) time — [min]
 $= \frac{l + l_c}{v} = \frac{l + l_c}{f \cdot N \cdot n}$

(or) MRR — material removal rate — [mm³/min]
 $= \frac{w \cdot d \cdot l}{t}$
(assuming $l_c \ll l$ you can use $MRR = w \cdot d \cdot v$)

Jan 5/23

Kinematics
Common to all milling types
Peripheral milling only

Milling Mechanics Summary - P1 - cont.

2 - Face/Vertical Milling

2/4

Symbol	Def ⁿ /Formula	Units
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D	Cutter Diameter	[mm]
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d	depth of cut (or axial depth of cut)	[mm]
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(or RDOC) w	width of cut (or radial depth of cut)	[mm]
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f	feed per tooth	[mm/tooth]
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(or 3) n	# of teeth on cutter	[teeth/rev]
----------	----------------------	-------------

F	Feed per revolution (= f · n)	[mm/rev]
---	----------------------------------	----------

N	cutter rotational speed (or spindle speed)	[rev/min]
---	---	-----------

(or fr) v	linear speed of workpiece (or feed rate)	[mm/min]
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$$= f \cdot N \cdot n$$

V	Surface speed of the cutter	[m/min]
---	-----------------------------	---------

$$= \pi D N$$

(or L) l	length of cut (full length = 1 pass)	[mm]
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(or A) l _c	approach distance to reach full cutter depth	[mm]
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Case a): when cutter is centered over the workpiece

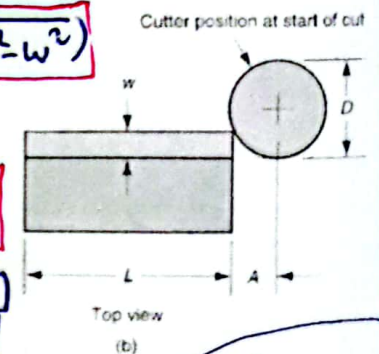
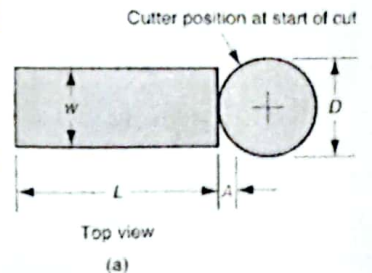
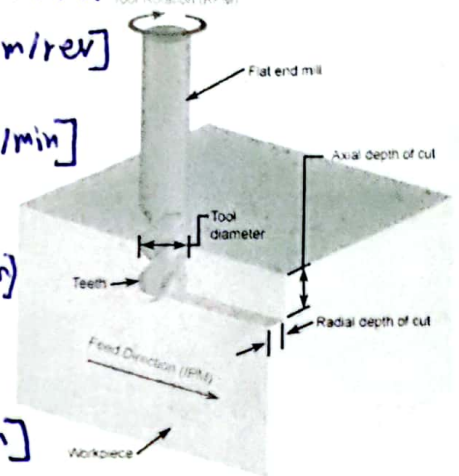
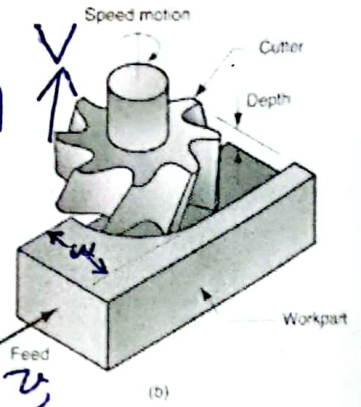
$$= 0.5(D - \sqrt{D^2 - w^2})$$

Case b): when cutter is offset to one side over the workpiece

$$= \sqrt{w(D-w)}$$

(or T _m) t	cutting/machining time	[min]
	$= \frac{l + l_c}{v}$	[s]
	$= \frac{l + l_c}{f \cdot N \cdot n}$	

(or Q) MRR	material removal rate	[mm ³ /min]
	$= \frac{w \cdot d \cdot l}{t}$	



Jon 25/23