Adda247

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"There is nothing impossible to they who will try."

GATE 2024

प्रचण्ड Batch

PRODUCTION

METAL CUTTING

LEC-5

Mechanical Engineering

GATE 2024

GATE

प्रचण्ड Batch

MECHANICAL ENGINEERING

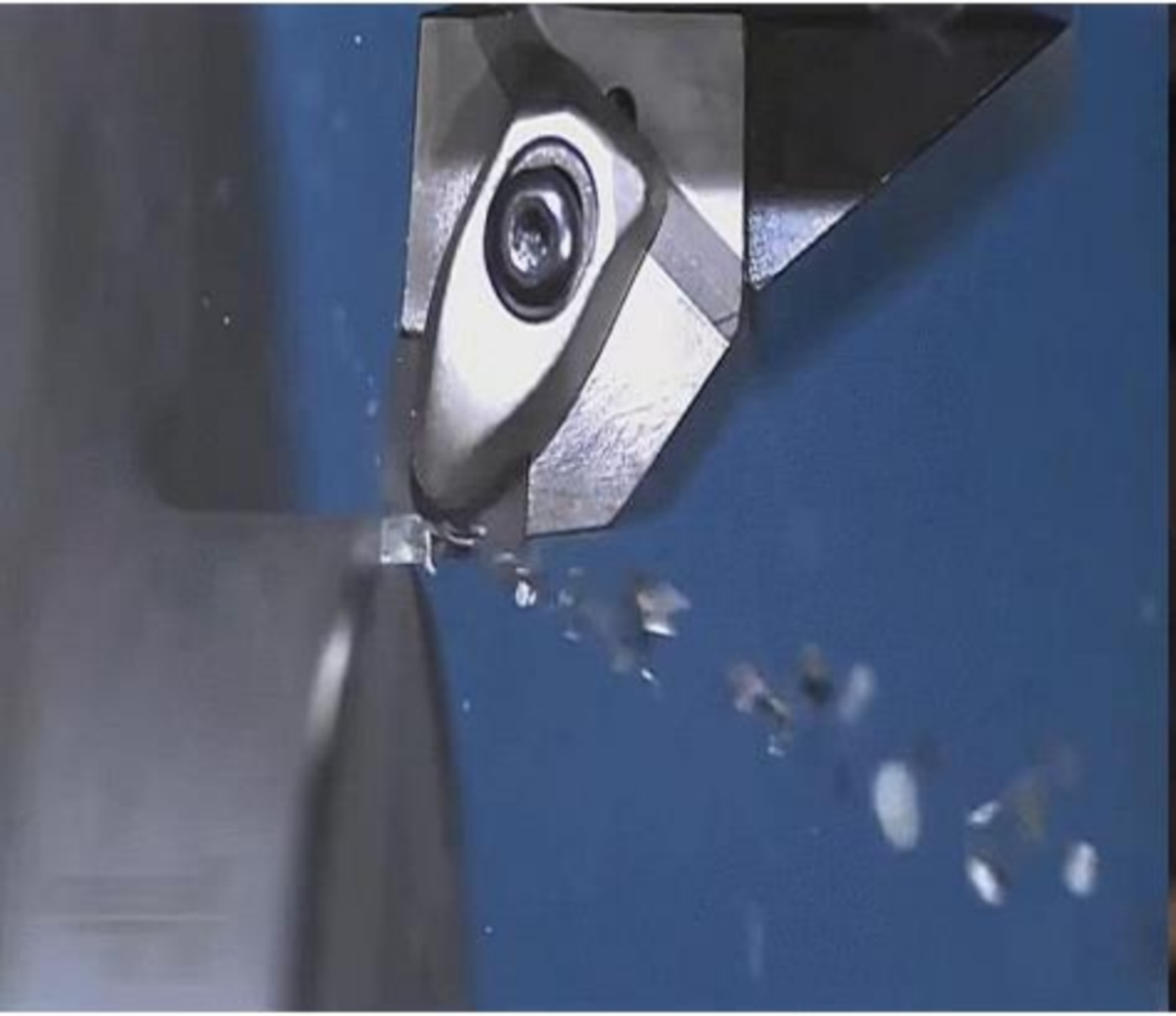
MON/ TUE/ WED- 9PM

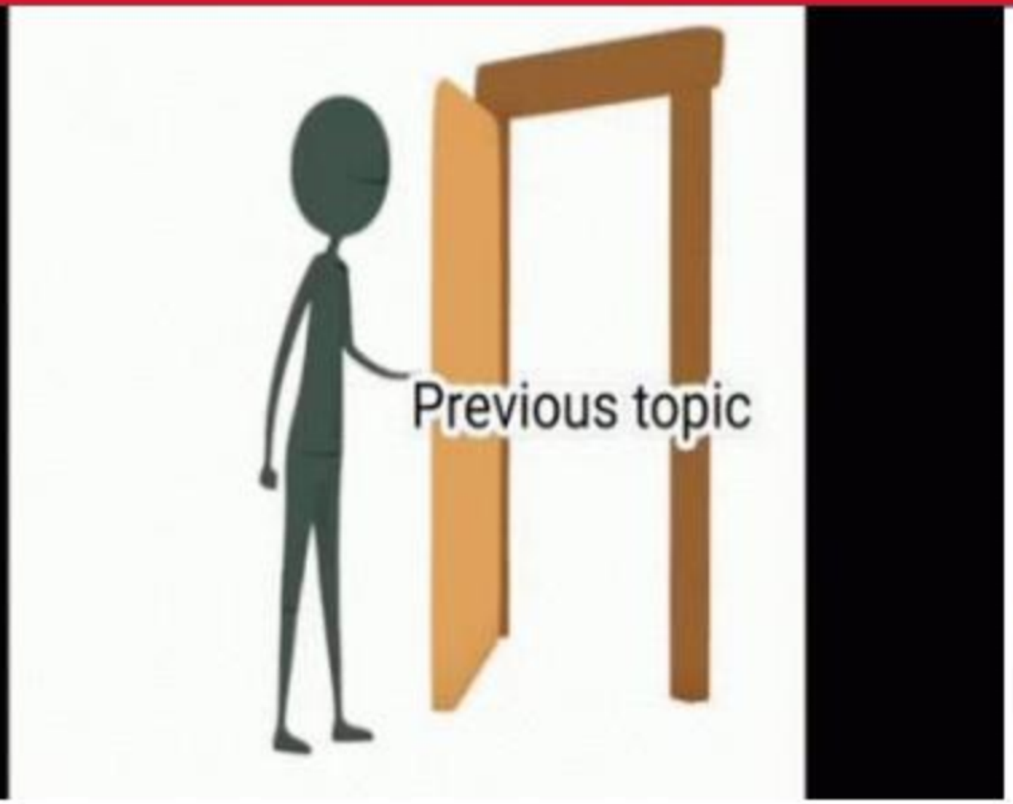
THEORY OF MACHINE (TOM)

THUR/ FRI/ SAT- 6PM

PRODUCTION ENGINEERING

METAL CUTTING





1.Itroduction to Metal cutting

2.Machining operation

3.Turning operation And analysis

4 .Orthogonal Machining Analysis

1.Side cutting edge angle And end cutting edge angle

2.Nose Radius

3.Shear Angle

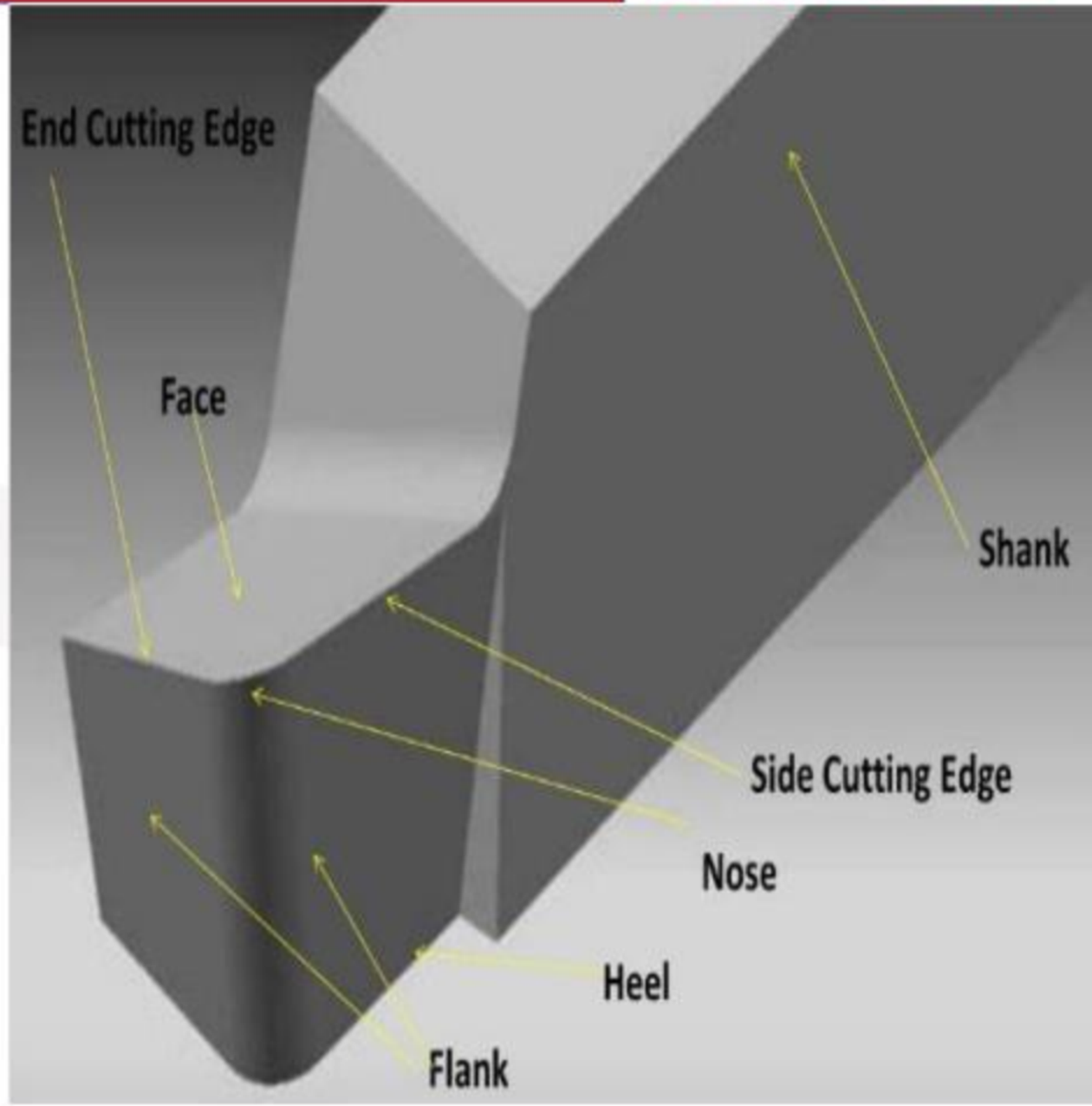
4.Velocity in Metal cutting

System of Description of Tool Geometry

1.Machine Reference System

2.Tool Reference System

3.Work Reference System



Tool Designation Or Tool Signature

3.Work Reference System (NRS)

⇓

Use before Invension of "ASA" and "ORS"

⇓

In this System only (2) Parameters

⇓

* α_n = Normal Rake Angle
* γ_n = Normal Relief Angle

ORS $\rightleftharpoons$ NRS

$* \quad \alpha_\eta = \tan^{-1}(\tan\alpha \cdot \cos i)$

$* \ i \longrightarrow$ ORS
$* \ \alpha \longrightarrow$ ORS
$* \ \alpha_\eta \longrightarrow$ NRS

\#

$\tan\alpha = \tan\alpha_s \cdot \sin\lambda + \tan\alpha_b \cdot \cos\lambda$

Critical corelation

$\alpha_s \rightarrow$ ASA

$\alpha_n \rightarrow$ NRS

$\alpha \rightarrow$ ORS

When $\lambda = 90^\circ \longrightarrow \alpha_s = \alpha$

When $i = 0 \longrightarrow \alpha_\eta = \alpha$

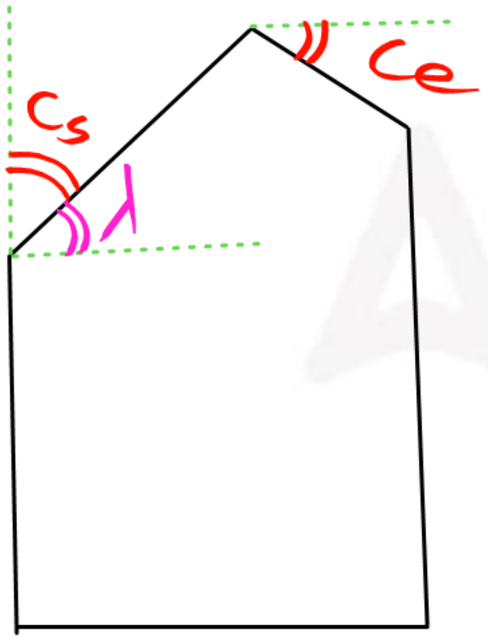
When $(\lambda = 90^\circ$ And $i = 0) \longrightarrow \alpha_s = \alpha_\eta = \alpha$

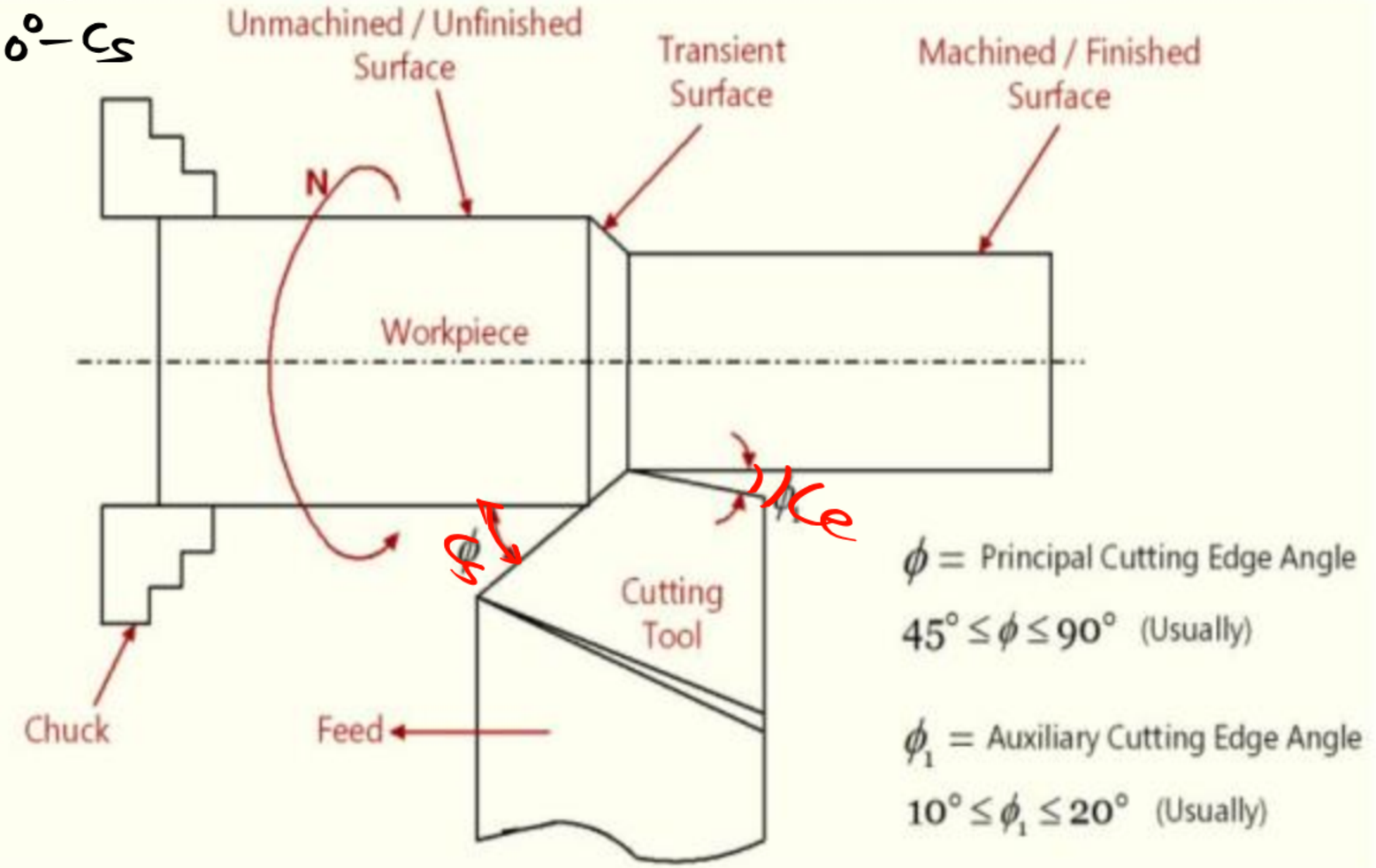
"Pure orthogonal cutting"

Side cutting edge angle And End cutting edge angle (Ce)

C_s

* $\lambda + C_s = 90^\circ$
* $\lambda = 90^\circ - C_s$





End cutting Edge Angle (Ce)

* It Prevent the Trailing Edge of Tool Rubbing against the w/p.
* Larger the value of "Ce" weaker will be Tool.
* It is Kept in b/w 8° to 15°.

Side cutting Edge Angle (C_s)

* It Prevent the Leading Edge of Tool interference into the w/p.

* F_x → Axial Force OR Feed force
* F_y → Radial force

* $F_y = F_t \cdot \cos\lambda = F_t \cdot \cos(90 - C_s) = F_t \cdot \sin C_s$

* $F_y = F_t \cos\lambda = f_t \cdot \sin C_s$

* $F_x = F_t \cdot \sin\lambda = F_t \cdot \cos C_s$

* Larger the "C_s" greater the component of force (F_y) tending to Seprate the work and Tool.

⇓

May Induce "Chatter".

⇓

(High Spot Mark)

* Its Value Kept in b/w 15^0 to 30^0.

* $C_e \rightarrow 8^0$ to 15^0
* $C_s \rightarrow 15^0$ to 30^0

⇓

$C_s > C_e$

⇓

To get Better Surface Finish

The diameter and rotational speed of job are 100mm and 500rpm respectively. The high spot(chatter mark) are found at a spacing of 30 degree on the job surface .Determine the chatter frequency.

Given Data :→

* D = 100 mm
* N = 500 Rpm
* Chatter Mark → 30°
* Chatter Frequency = ?

Solution :→

30° → 1 Mark

60° → 2

90° → 3

120° → 4

1 Rotation of Job ⇒ 360° → 12 Mark

✗ 1 min ⟶ 600 Rotation

✗ ∵ 1 min ⟶ 600 × 12 chatter Mark

$$\therefore \text{1 Sec} \longrightarrow \frac{\overset{100}{\cancel{600}} \times 12}{\cancel{60}\ 1} = 100 \text{ chatter Mark} \Rightarrow 100\ \text{Hz}$$

Surface Roughness (h)

$$h = \frac{f}{\tan C_s + \cot C_e}$$

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* $h \uparrow \Rightarrow$ Rough Surface
* $h \downarrow \Rightarrow$ Finish Surface

* $f \rightarrow$ feed (mm/rev)

When, $C_s \uparrow \Rightarrow h \downarrow$ (Good Surface finish)

When, $C_e \uparrow \Rightarrow h \uparrow$ (Poor Surface finish)

$\Rightarrow C_s > C_e$

$$h = \frac{f^2}{8R}$$

*

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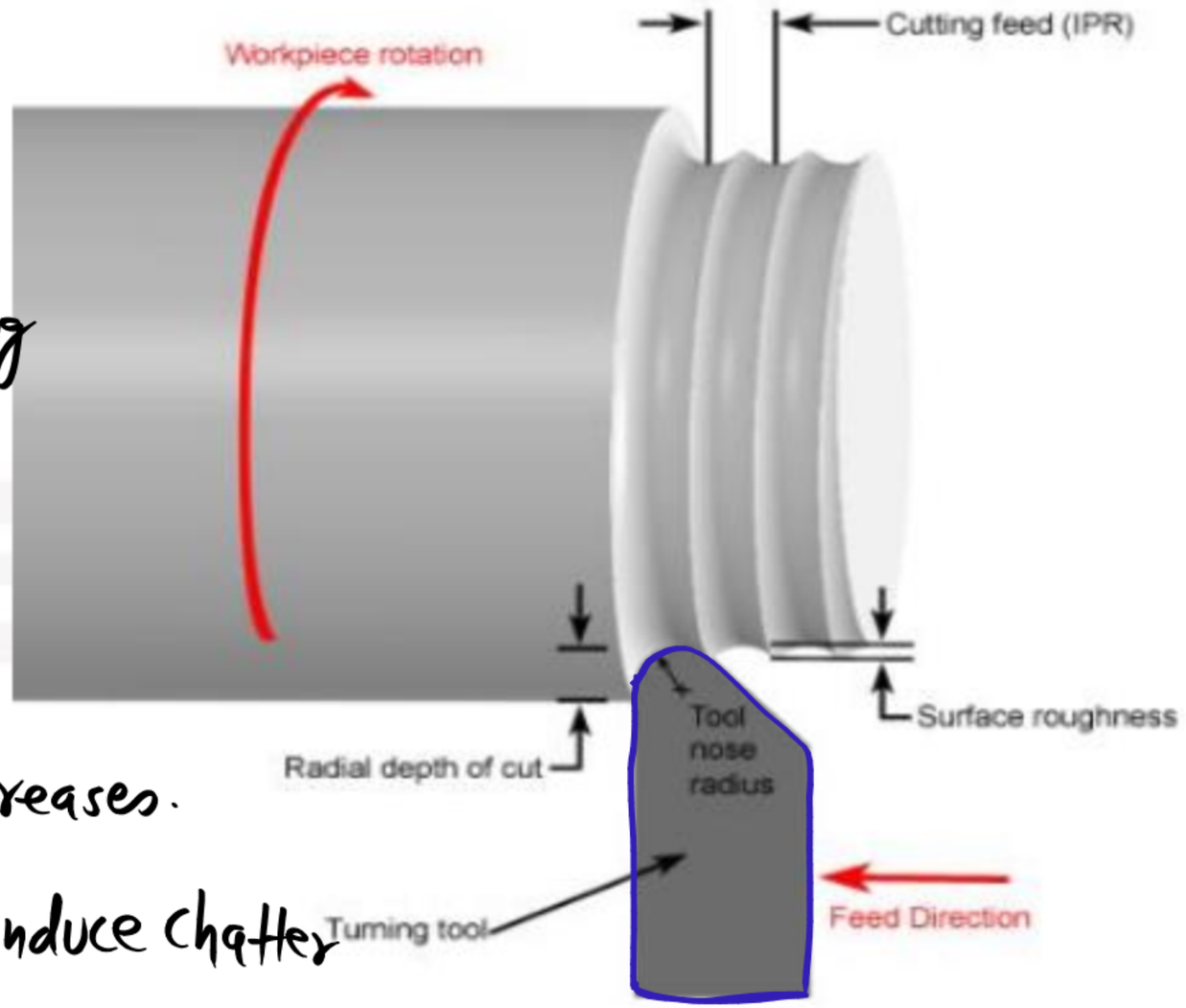
$f \rightarrow$ feed (mm/rev)

$R \rightarrow$ Nose Radius

When $R \uparrow \Rightarrow h \downarrow \Rightarrow$ Good surface finish

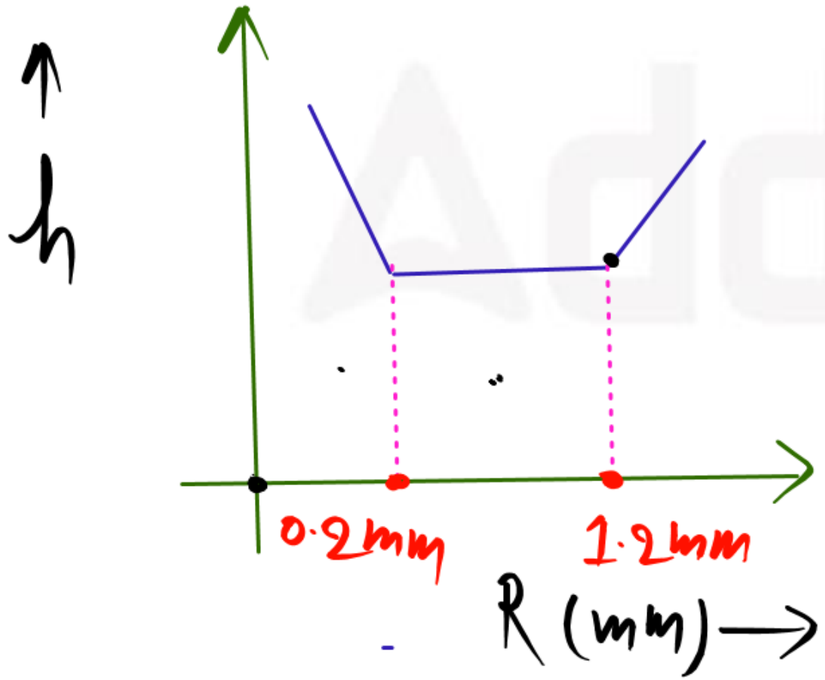
Nose Radius (R)

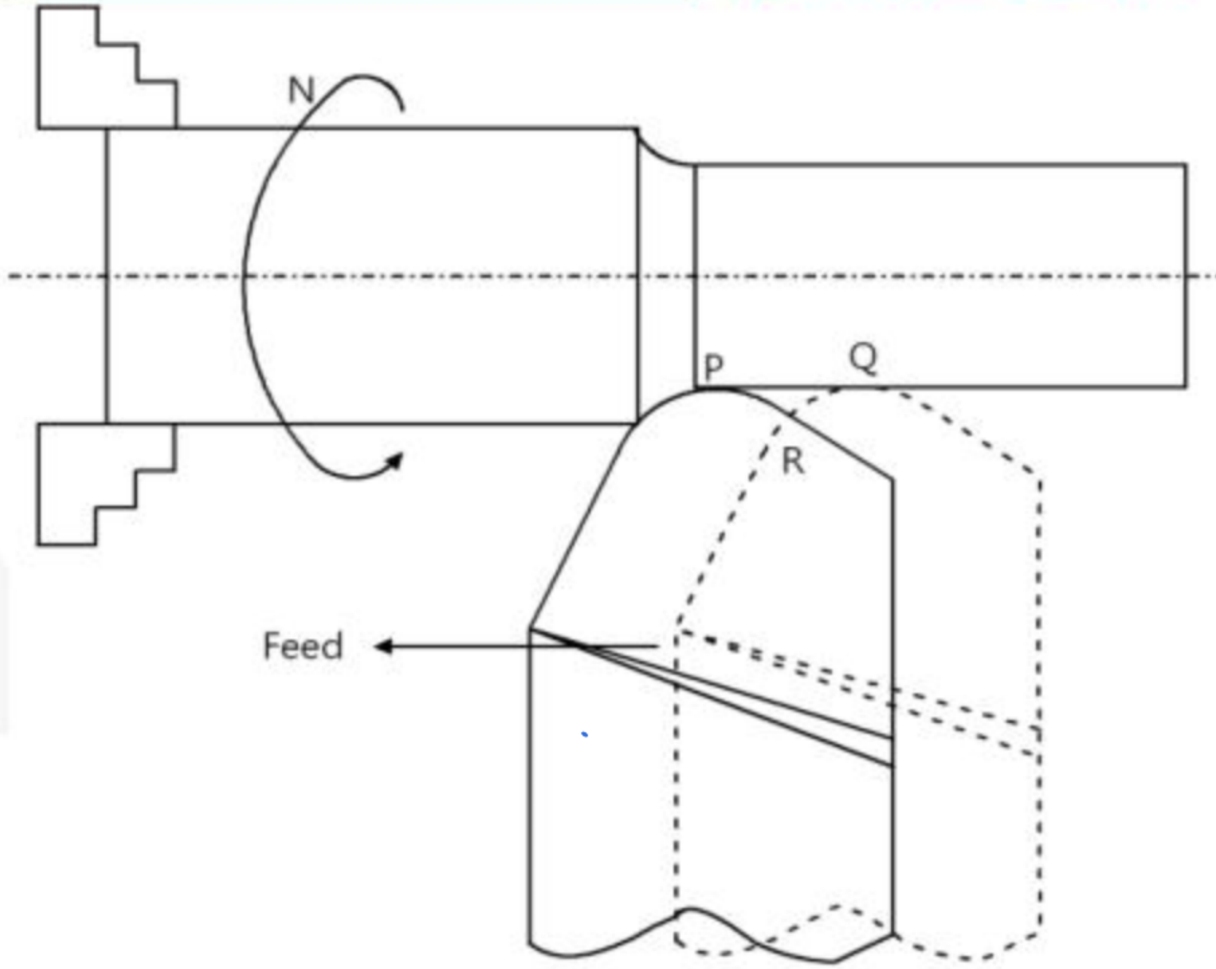
* It is curvature at Tool Tip.
* It Strength the tool tip by decreasing Stress concentration.
* It provide Better Surface finish
* If Nose Radius increase Force And Power consumption also increases.
* But too Large Nose Radius may induce chatter



* It increase the Tool life

* $0.2\,mm < R < 1.2\,mm$





$\uparrow \sigma_1 = \frac{P}{A_1 \downarrow}$

$\downarrow \sigma_2 = \frac{P}{A_2 \uparrow}$

$* \ \sigma_1 > \sigma_2$

$\downarrow$

Stress concentration

Nose Radius (R)

$\Downarrow$

Stress conc $\downarrow$

$\Downarrow$

Chance of failure $\downarrow$

$\Downarrow$

Tool life $\uparrow$

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