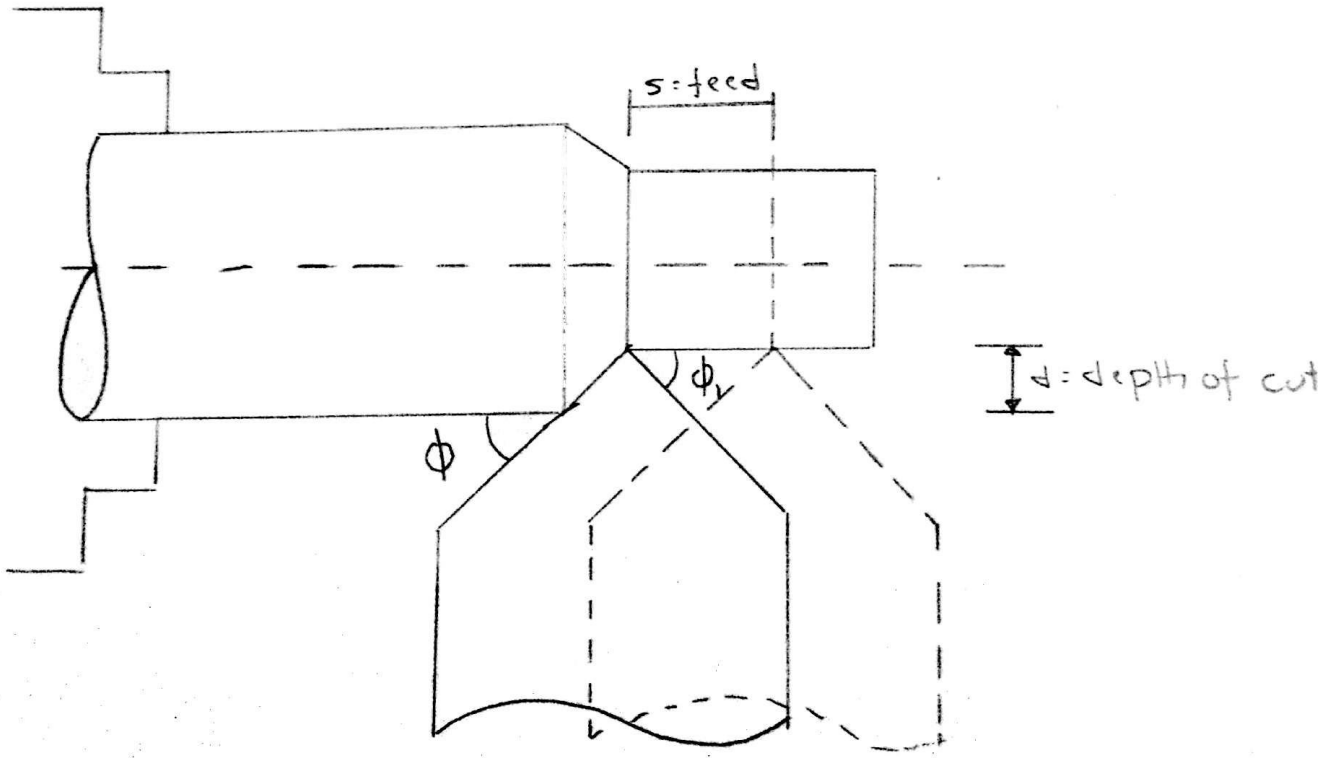
INDIAN INSTITUTE OF TECHNOLOGY

DATE 13.1.09 | Role of Process Parameters on Surface Finish. | SHEET NO.

Objective: To study the effect of feed and nose radius on surface roughness parameters in turning with a single point tool.

Experimental Conditions and Observations:-

Work material:	Ti 6Al 4V
Tool material:	P20 composite carbide (WC-Co)
Tool geometry:	0° 6° 6° 6° 75° 15° r
Depth of cut:	2mm
Cutting Velocity:	30m/min



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Sl. No.	Feed (mm/rev)	Nose radius (mm)	Ra (micron)	Rmax (micron)	Rz (micron)	hm (micron) /10
1	0.08	0.4	0.607	3.37	3.10	2.00
2	0.12	0.4	0.901	4.93	4.78	4.5
3	0.16	0.4	1.12	5.12	5.05	8
4	0.20	0.4	2.03	8.17	8.00	12.5
5	0.08	0.8	0.659	3.9	3.58	1
6	0.12	0.8	0.829	4.6	4.53	2.25
7	0.16	0.8	1.27	5.4	5.39	4
8	0.20	0.8	1.67	7.89	7.06	6.25
9	0.08	1.2	0.629	3.62	3.46	0.667
10	0.12	1.2	0.437	2.56	2.55	1.5
11	0.16	1.2	0.733	3.58	3.54	2.67
12	0.20	1.2	1.61	12.1	8.66	4.167

$$h_{max} = \frac{f^2}{8R}$$

hmax = Theoretical surface roughness parameter

& hm for all combinations.

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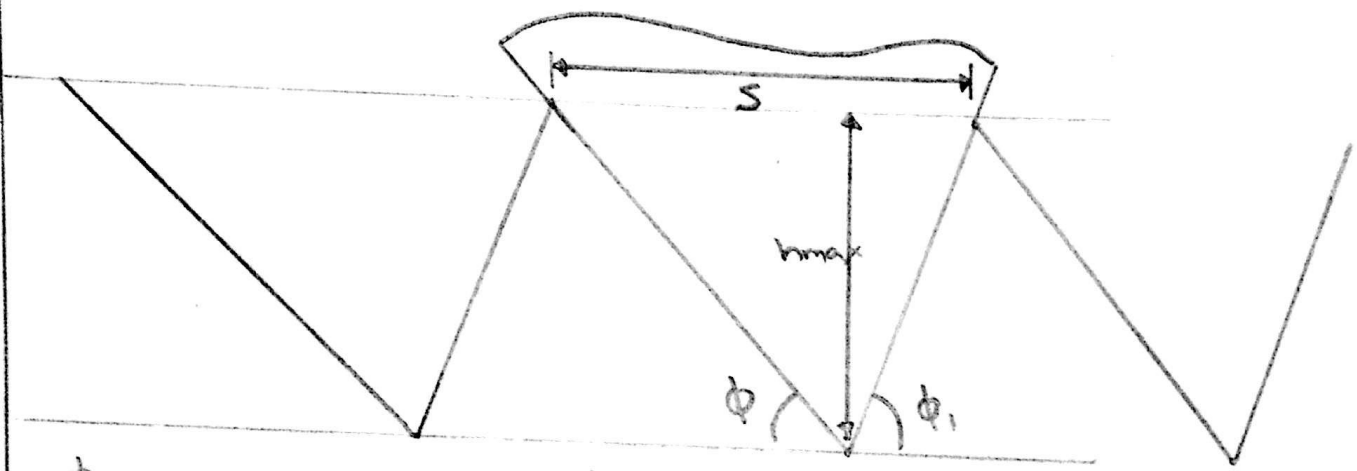
DISCUSSIONS:-

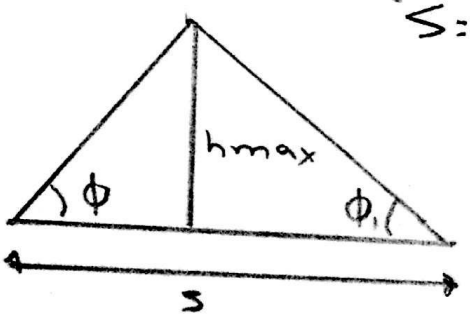
1. Derive the expression for surface roughness parameters with respect to tool geometry and feed.

Ans Case I : if tool is printed (S = feed)



ϕ = principle cutting edge angle

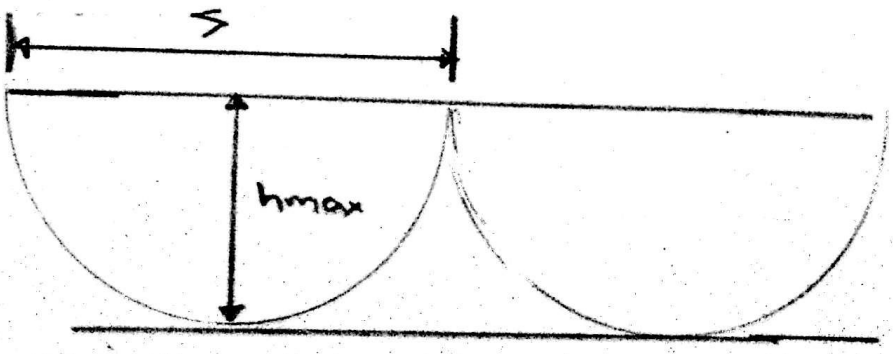
ϕ_1 = auxillary cutting edge angle

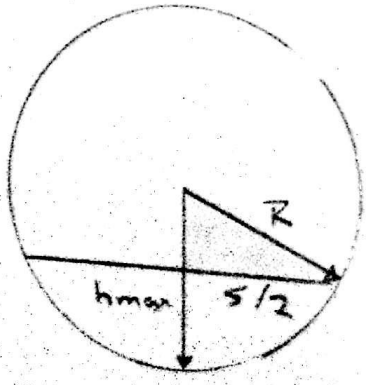


$$S = h_{max} \cot\phi + h_{max} \cot\phi_1$$

$$h_{max} = \frac{S}{\cot\phi + \cot\phi_1}$$

Case II: if tool is rounded with nose radius





$$h_{max} = R - \sqrt{R^2 - (s/2)^2}$$

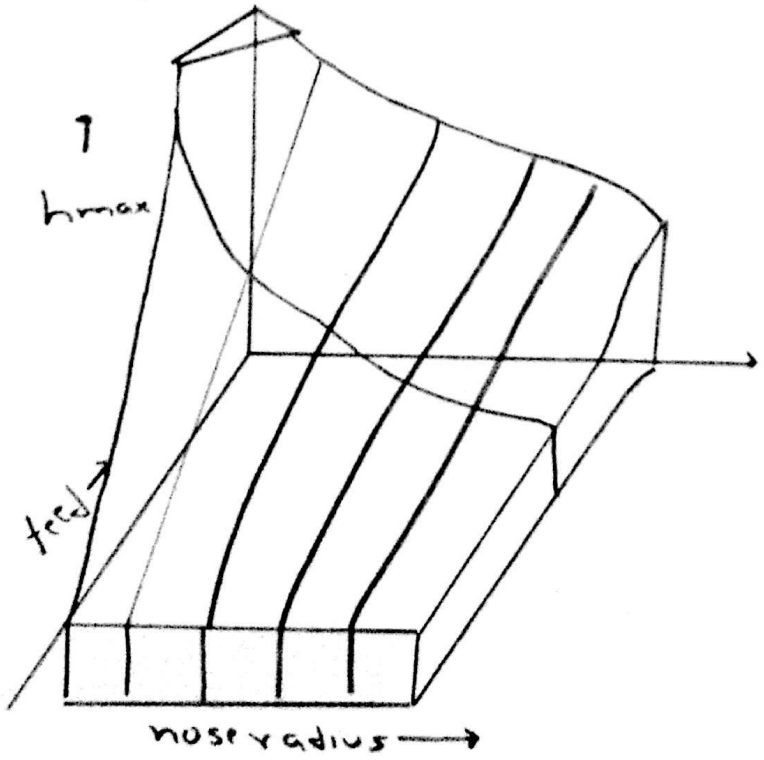
$$= R\left[1 - \sqrt{1 - \left(\frac{s}{2R}\right)^2}\right]$$

$$= R\left[1 - \left\{1 - \frac{1}{2}\left(\frac{s}{2R}\right)^2\right\}\right] \quad \text{(by binary expansion)}$$

$$= \frac{s^2}{8R}$$

3. Explain the nature of variation of surface roughness with feed and nose radius.

Ans. As evident from the formula, surface roughness increases with increased feed and decreases with increase in nose radius ($h_{max} = \frac{s^2}{8R}$). The variation may be plotted as.



Explain the reasons for variations between the theoretical and experimental values.

Ans As seen in the derivation of expression for surface roughness parameters with respect to nose radius

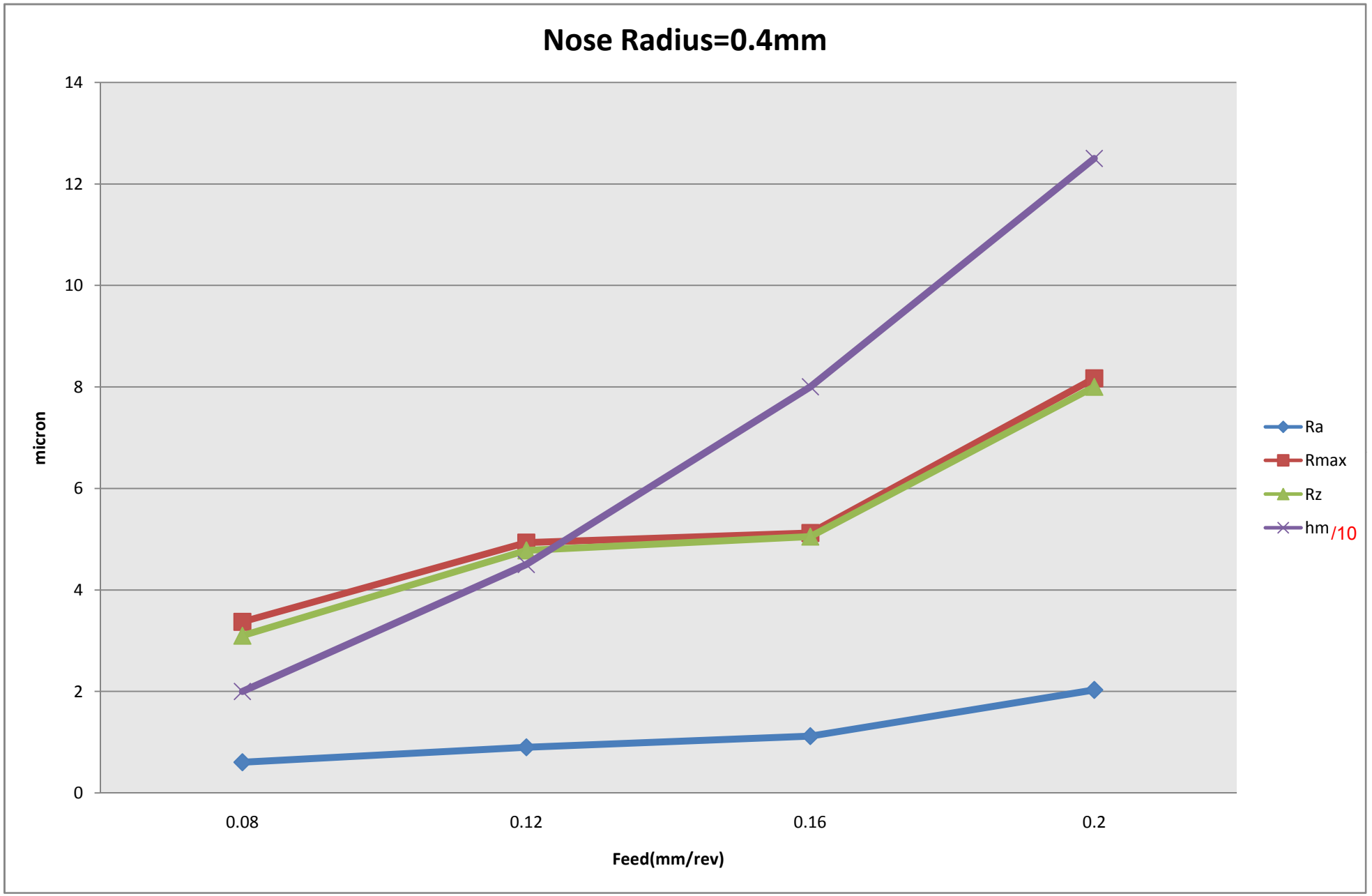
$$h_{theoretical} = R - \sqrt{R^2 - s^2/4}$$

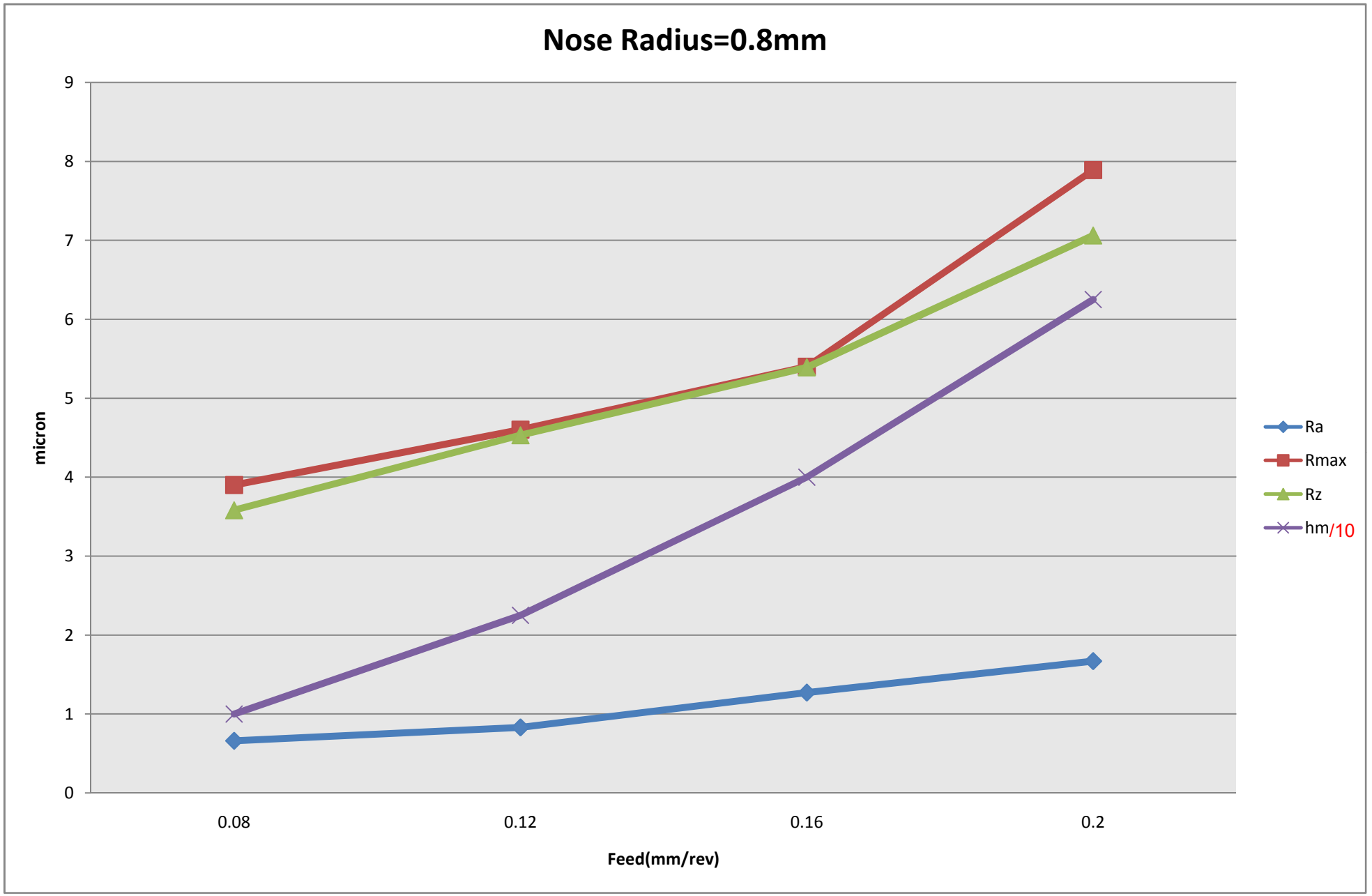
$$= R - R\sqrt{1 - \left(\frac{s}{2R}\right)^2}$$

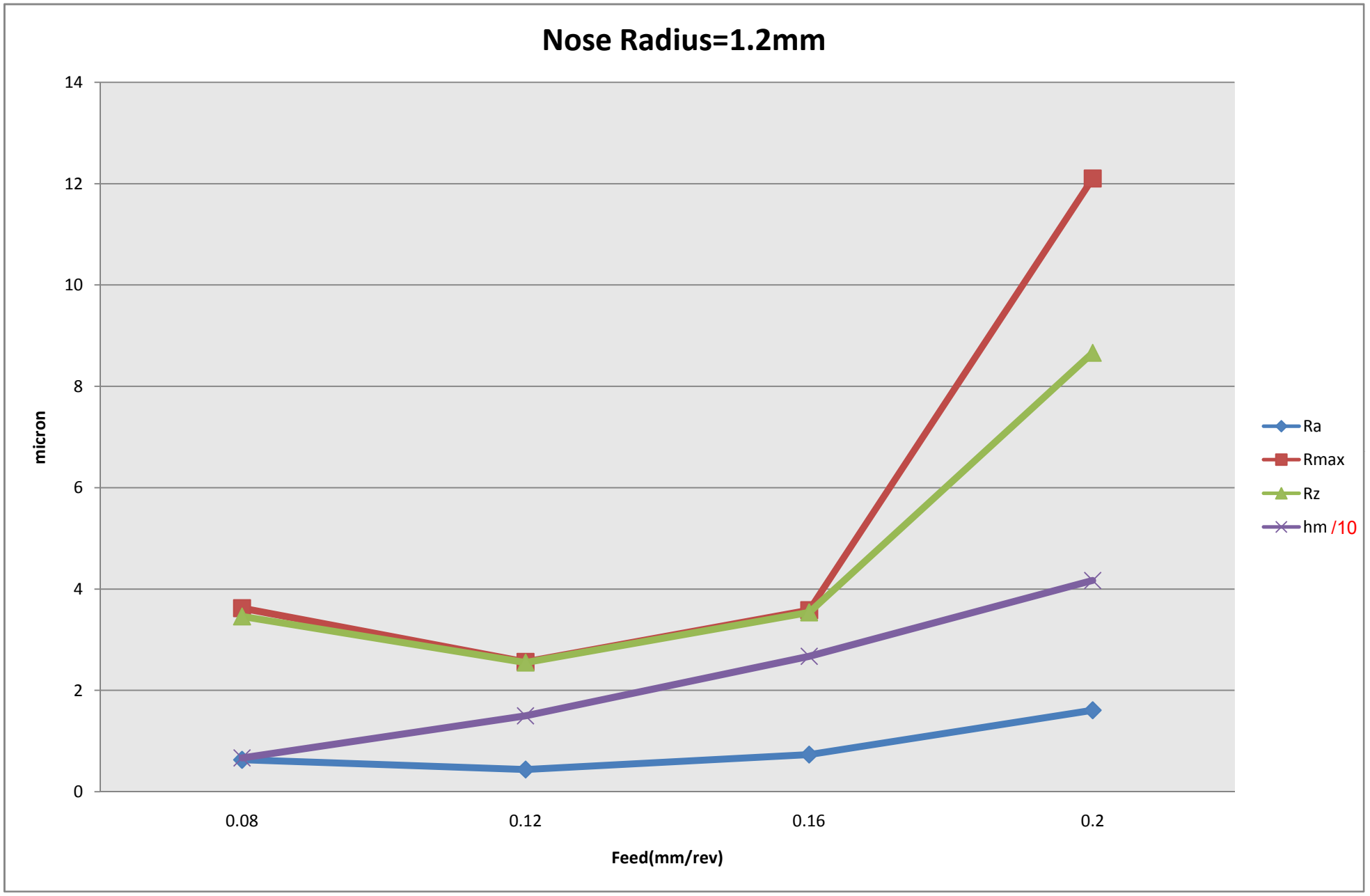
Now only when $s << R$ i.e feed << nose radius above formula reduces to $\frac{s^2}{8R} = h_{experimental}$

Hence there is a variation between the theoretical and experimental value as our assumption of ($s << R$) is not always valid.

Moreover due to experimental errors in the experiment theoretical and experimental value doesnot match


Nose Radius=0.4mm
14
12
10
8
6
4
2
0
micron
0.08
0.12
0.16
0.2
Feed(mm/rev)
Ra
Rmax
Rz
hm /10


Nose Radius=0.8mm
9
8
7
6
5
4
3
2
1
0
micron
0.08
0.12
0.16
0.2
Feed(mm/rev)
Ra
Rmax
Rz
hm/10


Nose Radius=1.2mm
14
12
10
8
6
4
2
0
micron
0.08
0.12
0.16
0.2
Feed(mm/rev)
Ra
Rmax
Rz
hm /10