Experiment-04

Name of the Experiment: Cutting tool grinding operation

Given tool (turning tool) geometry: In ASA system,
8°, 11.5°, 7°, 8°, 25°, 30°, 0" (inch)
Thus, $\gamma_y = 8°$, $\gamma_x = 11.5°$, $\alpha_y = 7°$, $\alpha_x = 8°$, $\phi_e = 25°$, $\phi_s = 30°$, $r = 0"$

In ORS system: 0°, 12°, 9°, 8°, 15°, 60°, 0 (mm)
Thus, $i = 0°$, $\gamma_o = 12°$, $\alpha_o = 9°$, $\alpha_o' = 8°$, $\phi' = 15°$, $\phi = 60°$, $r = 0mm$

Since single-point tools are preferably re-sharpened by grinding in maximum rake system (MRS) and minimum clearance system (MCS). Thus converting above given system into MRS system by using following formulae:

1. $\phi_r = \tan^{-1}\left(\frac{\tan\gamma_x}{\tan\gamma_y}\right) = \tan^{-1}\left(\frac{\tan(11.5°)}{\tan(8°)}\right) \Rightarrow \phi_r = 55.36°$

2. $\gamma_m = \tan^{-1}\left\{\sqrt{\tan^2\gamma_x + \tan^2\gamma_y}\right\} = \tan^{-1}\left(\sqrt{\tan^2(11.5°) + \tan^2(8°)}\right) = 13.889°$

3. $\phi_r = \underset{(60°)}{\phi} - \tan^{-1}\left(\frac{\tan i}{\tan\gamma_o}\right) = 60° - \tan^{-1}\left(\frac{\tan 0}{\tan(12°)}\right) = \cancel{55.36°}\ 60°$ (ORS to MRS)

4. $\tan\gamma_m = \sqrt{\tan^2\gamma_o + \tan^2 i} = \sqrt{\tan^2(12°) + \tan^2(0)} \Rightarrow \gamma_m = \tan^{-1}(\tan 12°) = 12°$ (ORS to MRS)

5. $\phi_\alpha = \tan^{-1}\left(\frac{\cot\alpha_x}{\cot\alpha_y}\right) = \tan^{-1}\left(\frac{\cot(8°)}{\cot(7°)}\right) = 31.11°$

6. $\cot\alpha_m = \sqrt{\cot^2\alpha_x + \cot^2\alpha_y} = \sqrt{\cot^2(8°) + \cot^2(7°)}$

$\Rightarrow \alpha_m = 5.28°$

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7. $\phi_r' = \phi_1 - \tan^{-1}(\tan\alpha_o' \tan d') = 60° - \tan^{-1}\left(\frac{0.0199}{10.23}\right) = 59.88°$

8. $\cot\alpha_m' = \sqrt{\cot^2\alpha_o' + \tan^2 d'} = 10.23 \Rightarrow \alpha_m' = \cot^{-1}(10.23)$

$\Rightarrow \alpha_m' = 5.583°$

Procedure:

1. Grinding of tool rake surface in MRS:

- Values of ϕ_r (orientation angle) and γ_m (setting angle, i.e. maximum rake angle) was calculated from the given tool geometry in ASA, ORS and NRS.
- The tool shank was placed below the grinding wheel of the tool and the cutter grinder, keeping the shank parallel to the wheel axis.
- Now the shank was rotated (oriented) about the Z_m axis by an angle of $90° - \phi_r$ to bring the master line (ML) parallel to the wheel axis.
- Now the tool was tilted about the master line by maximum rake angle γ_m.
- The tool-table was reciprocated as such bringing the tool (rake face) in contact with the wheel surface for grinding action.
- Reciprocation was repeated with small infeeds.

2. Grinding of Principal Flank in MRS:

- For this, the value of ϕ_r and α_m was determined from the given tool geometry.

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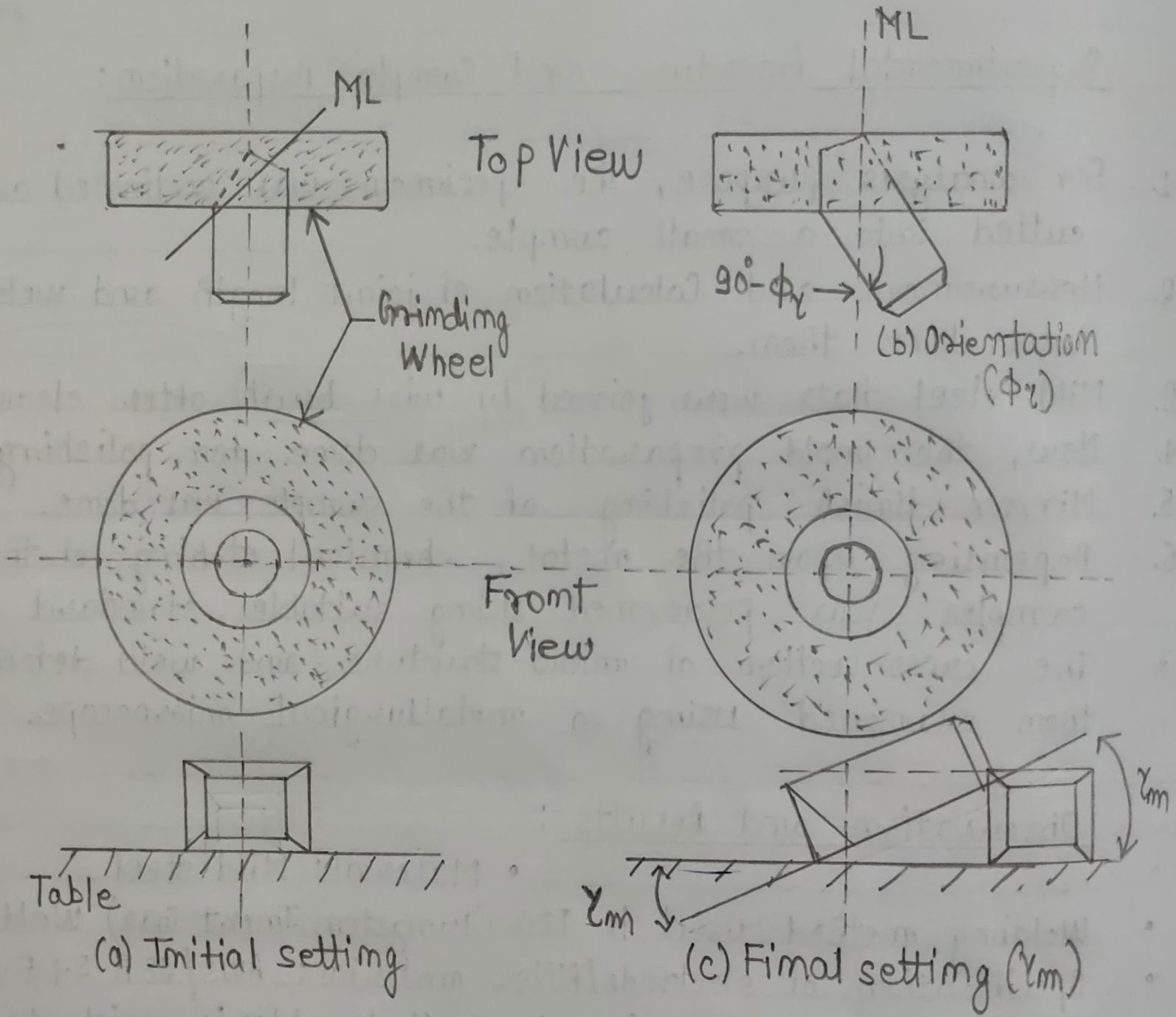

Setting for grinding tool (single-point) rake surface in MRS

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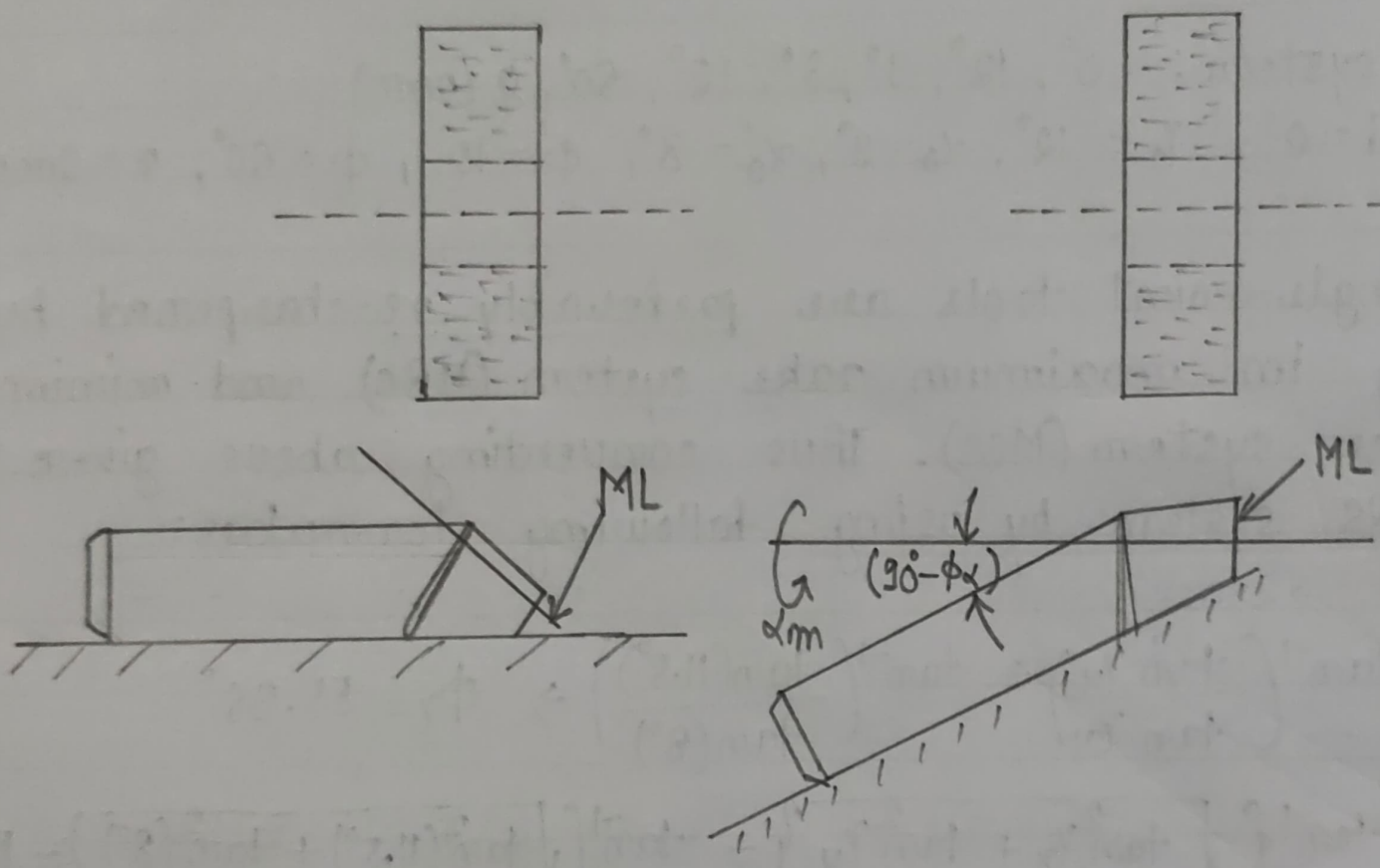

Grinding of principal flank in MRS

- Placed the tool shank below the grinding wheel.
- The tool was now rotated about Z_m axis by $90° - \phi_x$ to bring the master line (ML) of the principal flank parallel to the wheel axis.
- Rotated the tool shank (vice) about the master line by α_m.
- The tool was reciprocated (flanked) in contact with the wheel.
- Reciprocation was repeated with slight infeeds.

3. Grinding Auxiliary flank surface in MRS:

- The values of ϕ_x' and α_m' of the auxiliary flank was determined from the given tool geometry.
- The tool shank was placed below the grinding wheel.
- The tool was made rotated by an angle ϕ_x' to bring the master line parallel to the wheel axis.
- Rotated the tool about the master line of the auxiliary flank by α_m'.
- The table with the tool was reciprocated against the grinding wheel periphery.
- Reciprocation was repeated with small infeeds.

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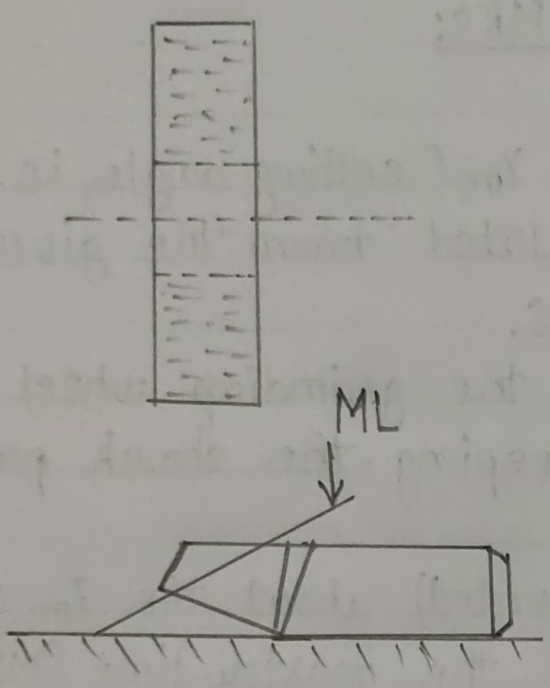

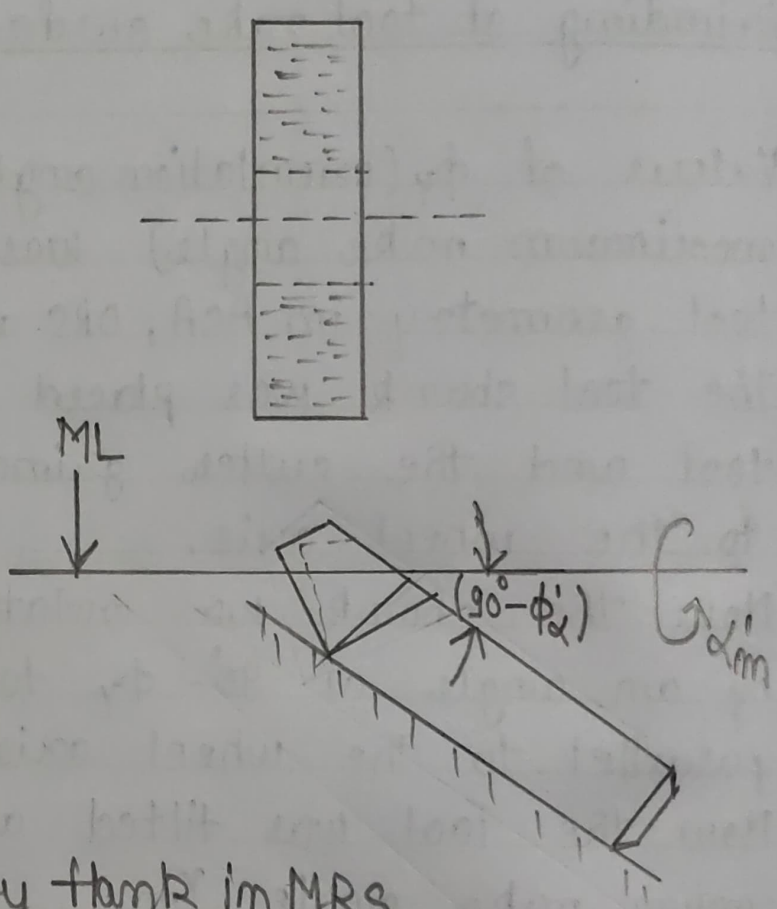

Grinding of auxiliary tank in MRS