$$T_d = \frac{V_{1e}^2}{\left(R_{1e} + \cancel{R_2'}\,\frac{R_2'}{s}\right)^2 + \left(X_{1e} + X_2'\right)^2} \; \frac{\frac{R_2'}{s}}{W_{syn}}$$

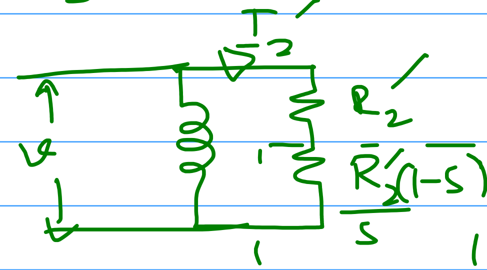
$\frac{R_2'}{s}$ is unchange then T_d is unchanged

Rotor Cu Loss $= I_2'^2 R_2'$

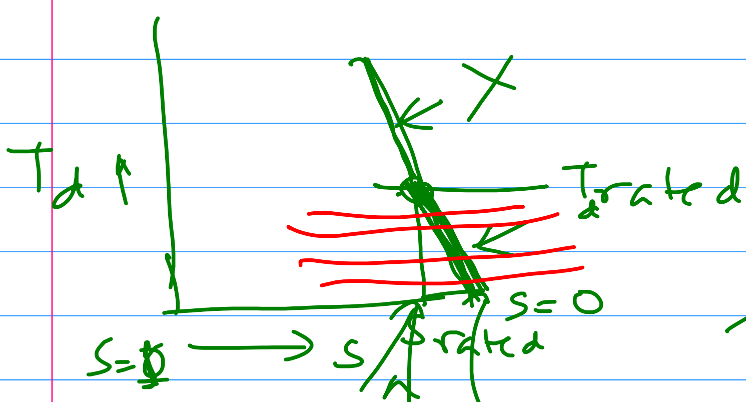
I_2' is unchanged is $\frac{R_2'}{s}$ ratio is unchanged.

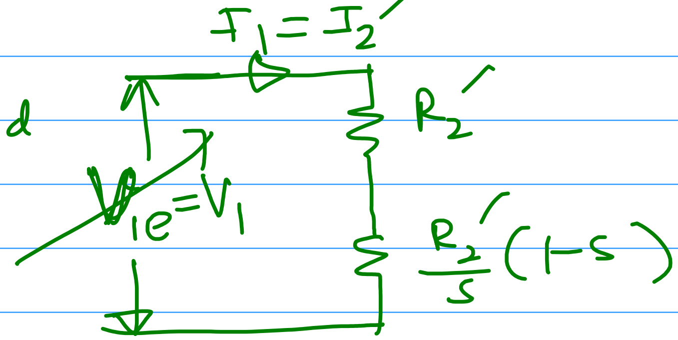
$$\eta = \frac{I_2'^2 \frac{R_2'}{s}(1-s)}{I_2'^2 \frac{R_2'}{s}}$$

$= (1-s)$



better to operate at low slip for better efficience



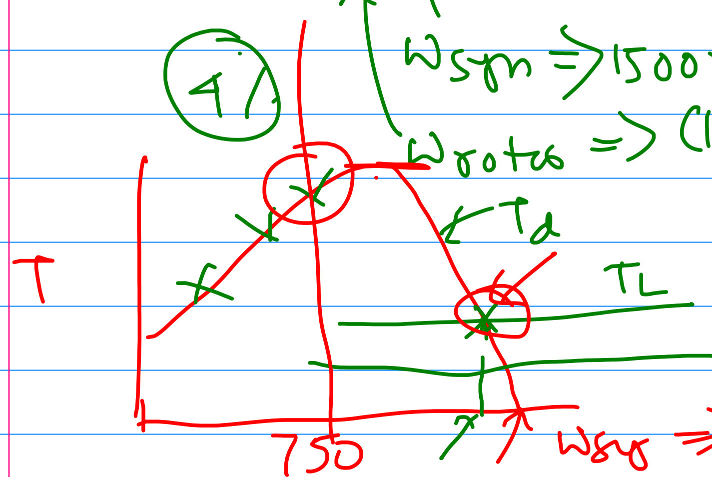


4)

$W_{syn} \Rightarrow 1500\,rpm$

$W_{rotor} \Rightarrow (1-s) \times 1500 = (1-.04) \times 1500$

$= 1440\,rpm$



50 nM (external) ← ~~1440~~ rpm W_{rotor}

25 nM ← 1470 rpm (W_{rotor})

$W_{syn} \Rightarrow 1500\,rpm$

Slip is very low

$$T_d \cong \left(\frac{V}{\frac{R_2}{s}}\right)^2 \times \frac{1}{\omega_{syn}} \times \frac{R_2}{s}$$

X negli.

$$\frac{R_2'}{s}$$

$$\simeq \left(\frac{V}{\omega_{syn}}\right)^2 \frac{\omega_{syn} \times s^2 \times}{\cancel{s}\ R_2'}$$

$s \to 0$

$$\simeq \left(\frac{V}{\omega_{syn}}\right)^2 \frac{\boxed{s\,\omega_{syn}}}{R_2'}$$

$$s = \frac{\omega_{syn} - \omega_{r}}{\omega_{syn}}$$

$R_2' = \text{const}$

Adjustable $\omega_{syn} = \omega_{rotor} + \cancel{s\omega_{syn}}$ (measurement)

V : Terminal voltage $\longrightarrow$ Adjustable

$\omega_{syn} \Rightarrow \omega_{supply} \times \frac{2}{P} \longrightarrow$ Adjustable

$$\cancel{\frac{V}{\omega_{syn}}} = \text{const}$$

$$T_d \propto \cancel{s\,\omega_{syn}}$$

$s\omega_{syn_1} = 60\ rpm$

$s_1 = .04$

$\omega_{syn_1} = 1500$

$\omega_{syn_2} = 750\ rpm$

$s_2 \omega_{syn_2} = 60\ rpm$

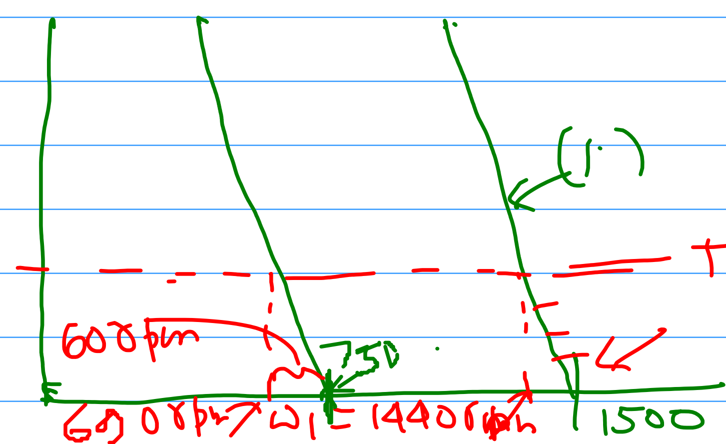
$s_2 \times 750 = 60$

$$s_2 = \frac{60}{750} = .08$$

$V_2 \Rightarrow \frac{415}{2}$

$\omega_{syn} \Rightarrow 750\ rpm$

$s\,\omega_{syn}$



$T_d = 50\ Nm$

$$\boxed{T_d \propto s\,\omega_{syn}}$$

W_{rotor} = unchange at 690 rpm

$\frac{60}{750} = 8\%$

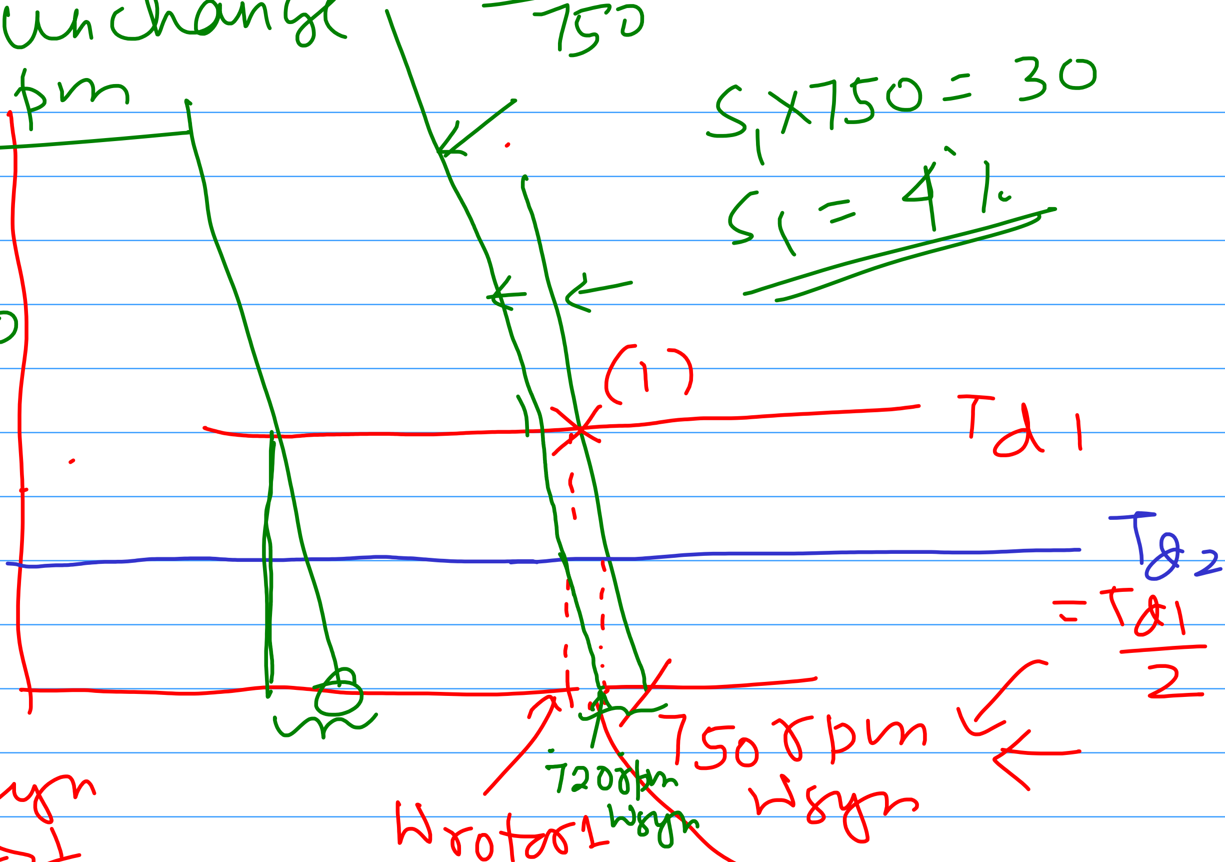
$S_1 \times 750 = 30$

$S_1 = 4\%$

$S_2 \times 720 = 30$

$S_2 = \frac{30}{720}$

$= 4.166\%$



$T_d \propto s W_{syn}$

$S_2 W_{syn2} \Rightarrow \frac{1}{2}$

$= 30$ rpm

$\frac{V}{W_{syn}} \Rightarrow \phi_m$..

$V = 4.44 f \underbrace{B_m A_c}_{\phi_m} N_{ph}$

$\frac{V}{f} = 4.44 \phi_m N_{ph}$

Keeping the maximum flux constant over the speed range.

$T_d \propto \boxed{s W_{syn}}$