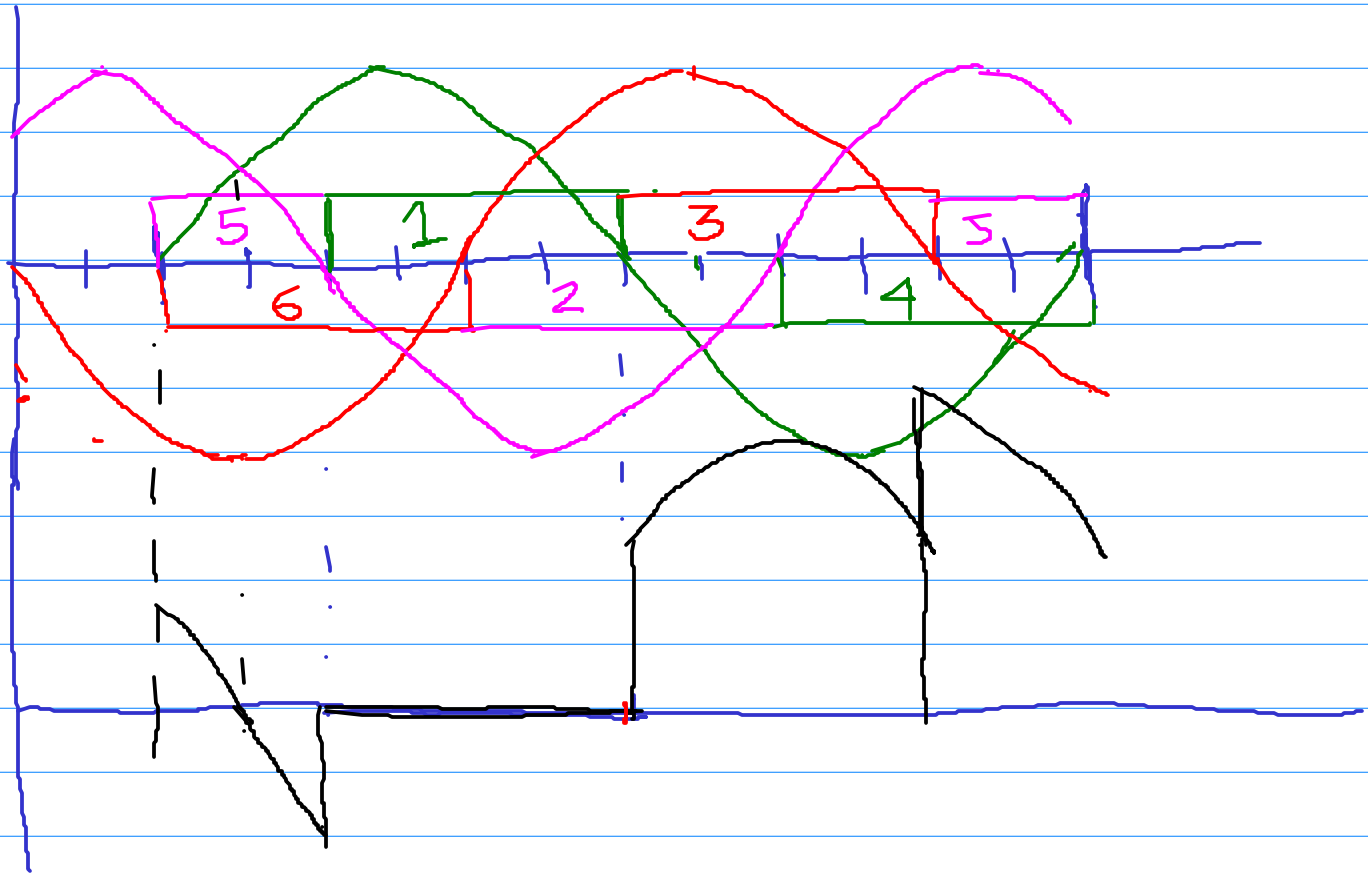
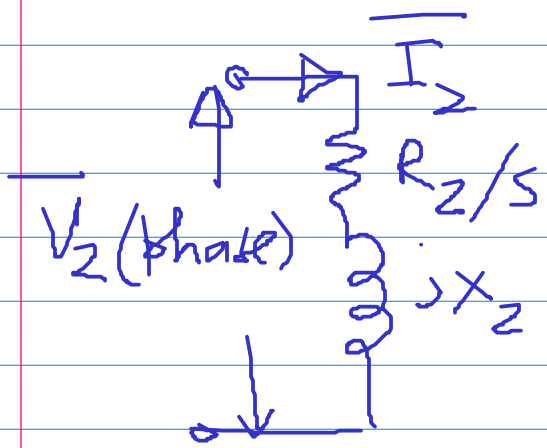
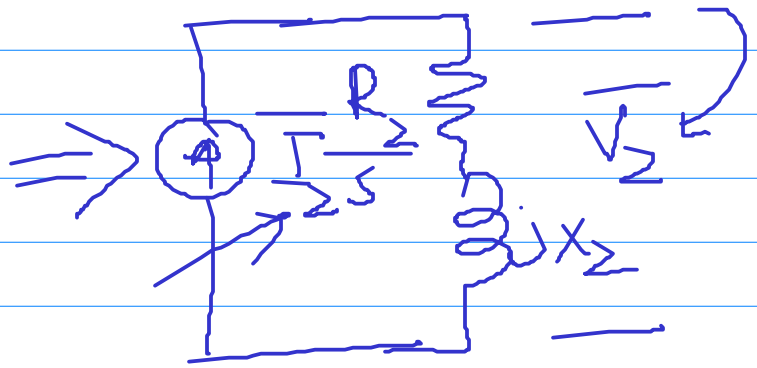

5
1
3
5
6
2
4

A 3 phase, 50 Hz, 4 pole, 415 V, 500 hp squirrel cage induction machine develops rated torque at 3% slip and maximum torque at 12% slip. This is driven by a current fed induction motor drive. Draw the schematic of such a system that uses Thyristor as the switching device. Find the firing angle α_1 and α_2 of the grid side and machine side converters respectively when the machine is running at 705 rpm and the stator supply frequency is 25 Hz. Note that the current of the current source inverter is maintained constant at the same level as in the rated condition.



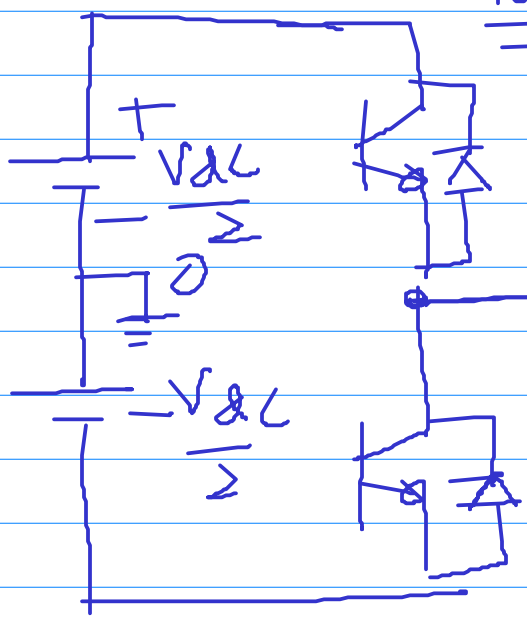
Voltage Source Inverter



Current Source Inverter

1200V

800V
600V



Two level inverter

V_{PO}
$(+\frac{V_{dc}}{2}, -\frac{V_{dc}}{2})$

Current Source Inverter (Thyristor)
- leading pf load
- Lagging pf load

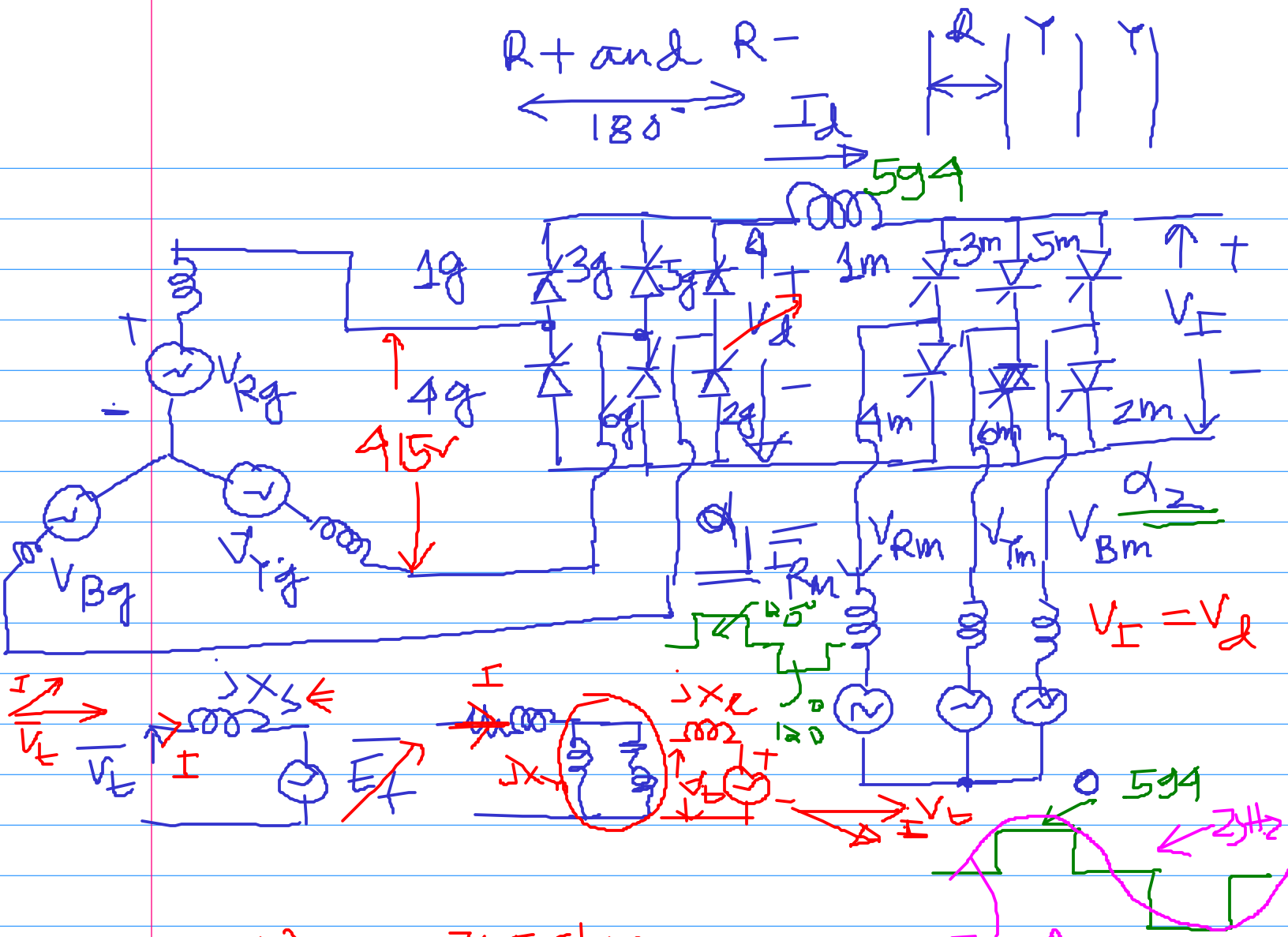
Current source inverter → leading pf → (Load commutation) → NO external commutation circuit

Lagging pf → (Forced commutation)

(i) ASCI - Inverter
- lagging
- leading

(ii) Putting capacitors at the load terminal so that the load appears to be a leading pf load to the inverter

Current Source inverter + Synchronous Machine (leading pf by field control)



$W_{R2} = 705 \text{ r/m}$

$W_{sync2} = 750 \text{ r/m} \rightarrow$ 25Hz stator frequency

$S_2 = \frac{45}{750} = .06$

$\alpha_2 = 26.5°$

V_{2ph}

I_2 phase

$224.3 \times 1.35 \times 26.5$

$V_I = 271V \Rightarrow V_d$

$415 \times 1.35 \cos\alpha_1 = 271$

$\alpha_1 = 61°$

$535\angle 0°$

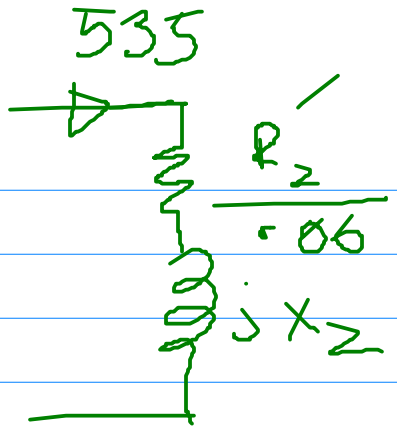
$.013 + j.108$ / $.06$

$535 \times \left(\frac{.013 + j.108}{.06}\right)$

$= 129.5\angle 26.5°$ (Phase)

$V_{LL2} = \sqrt{3} \times 129.5$

$= 224.3V$



$$\left[\frac{535^2 \times \frac{.013}{.06}}{2\times\pi\times\frac{25}{2}}\right] \times 3$$

$$= 2368.8 \text{ Nm}$$

$$\frac{535^2 \times \frac{.013}{.03}}{2\pi \times 5D/2} \times 3 \Rightarrow 2368.8 \text{ Nm}$$