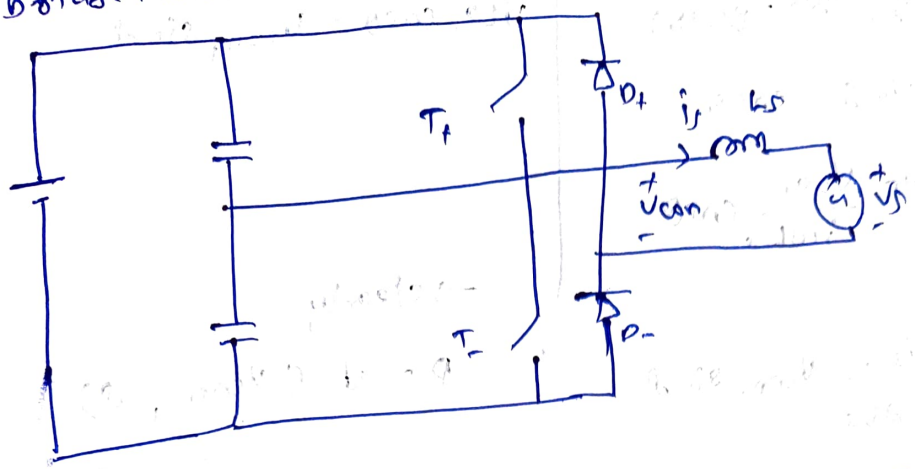
(04) Regeneration mode of IM through a half bridge inverter.



→ in regenerative mode ie; rectification mode, the energy is fed back from IM to dc source of the system. ie IM works as asynchronous generator.

V_s = sinusoidal back emf

$V_{LS} = L_s \frac{di_s}{dt}$

or $V_{LS} = j\omega L_s i_s$

$-V_{con} + V_{LS} + V_s = 0$

$\therefore V_{con} = V_{LS} + V_s$

∴ taking fundamental frequency

$V_{con_1} = V_{LS_1} + V_s$

or $V_{con_1} = L_s \frac{di_{s_1}}{dt} + V_s$

& $V_s = V_{con_1} - V_{LS_1}$

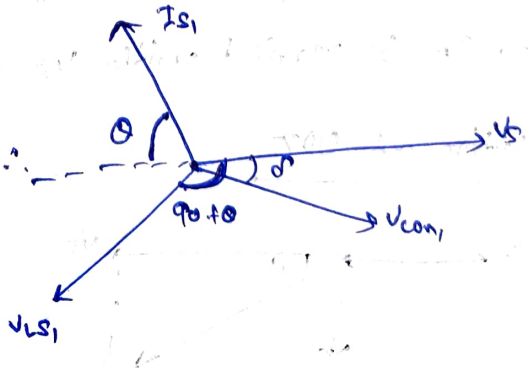
$V_s = V_{con_1} - j\omega L_{s_1} i_1$

∴ direction of i_1 decides inverson or rectification mode.

→ for regenerative ie; rectification mode, is is -ve or backward direction.

∴ Rectification mode

→ V_{con_1} lags V_s by δ



→ real power at ac side

$$P = V_s I_{s_1} \cos(180+\theta)$$

or $$P = -V_s I_{s_1} \cos\theta$$

$$P = -V_s \frac{V_{LS_1}}{j\omega L_s} \cos\theta$$

$$\therefore -P = -\frac{V_s}{j\omega L_s} V_{con_1} \sin\delta$$

or $$P = -\frac{V_s^2}{j\omega L_s} \cdot \frac{V_{con_1}}{V_s} \sin\delta$$

also

$$V_{LS_1} \cos\theta = V_{con_1} \sin\delta$$

→ clearly $P = f(V_{con_1}, \delta)$

→ reactive power

$$Q = V_s I_{s_1} \sin(180+\theta)$$

$$= V_s I_{s_1}(-\sin\theta)$$

$$= -V_s \frac{V_{LS_1}}{j\omega L_s} \sin\theta$$

$$= \frac{-V_s}{j\omega L_s} [V_s - V_{con_1} \cos\delta]$$

or $$Q = \frac{-V_s^2}{j\omega L_s} \left[1 - \frac{V_{con_1}}{V_s} \cos\delta\right]$$

also

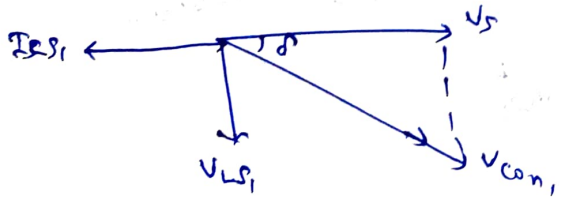
$$V_{LS_1} = V_s - V_{con_1} \cos\delta$$

→ clearly $Q = f(V_{con_1}, \delta)$

∴ value of P & Q can be varied by manipulating the value of V_{con_1} & δ at Ls & V_s fixed.

→ V_{con_1} can be varied with V_s & I_{s_1} constant.

rectification at UPF



$$V_{con_1} = \sqrt{V_s^2 + (\omega L_s I_{s_1})^2}$$