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NPTEL ONLINE CERTIFICATION COURSE

Charging Infrastructure

Lecture-19

Totem pole PFC Converter-II

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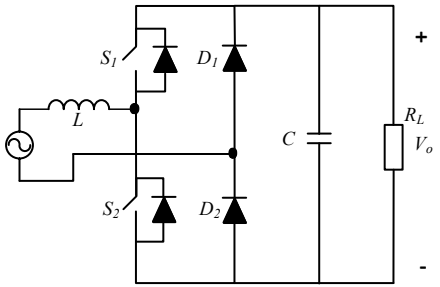
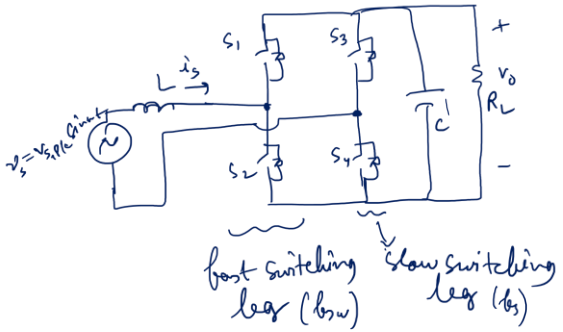
Recap





$$I_{s1,rms} = \sqrt{\frac{1}{T}\left[\int_0^{T_{sw}} \left((1-d(t))\, i_s^2(t)\right) dt + \int_{T_{sw}}^{T} \left(d(t)\, i_s^2(t)\right) dt\right]}$$

$$I_{s2,rms} = \sqrt{\frac{1}{T}\left[\int_0^{T_{sw}} \left(d(t)\, i_s^2(t)\right) dt + \int_{T_{sw}}^{T} \left((1-d(t))\, i_s^2(t)\right) dt\right]}$$

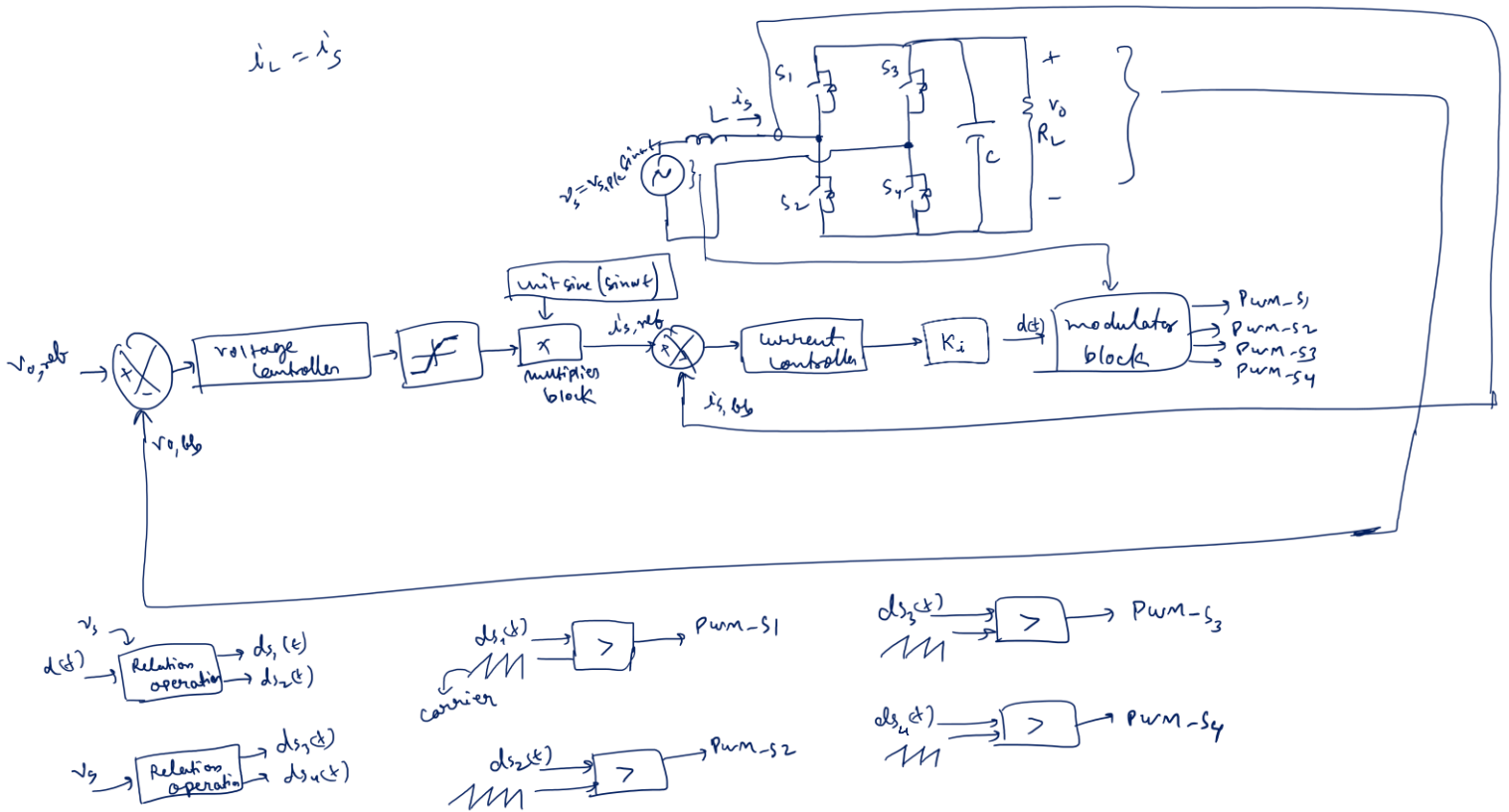
$$i_s(t) = I_{s,pk} \sin \omega t$$

$$d(t) = 1 - \frac{|V_{s,pk} \sin \omega t|}{V_o}$$

$$\omega T = 2\pi$$

$$L = \frac{V_o}{4\, \Delta i_{L,max}\, f_{sw}} \quad ; \quad C = \frac{P_L}{2\pi f_s\, \Delta V_o \cdot V_o}$$

→ Same as that of Boost PFC converter

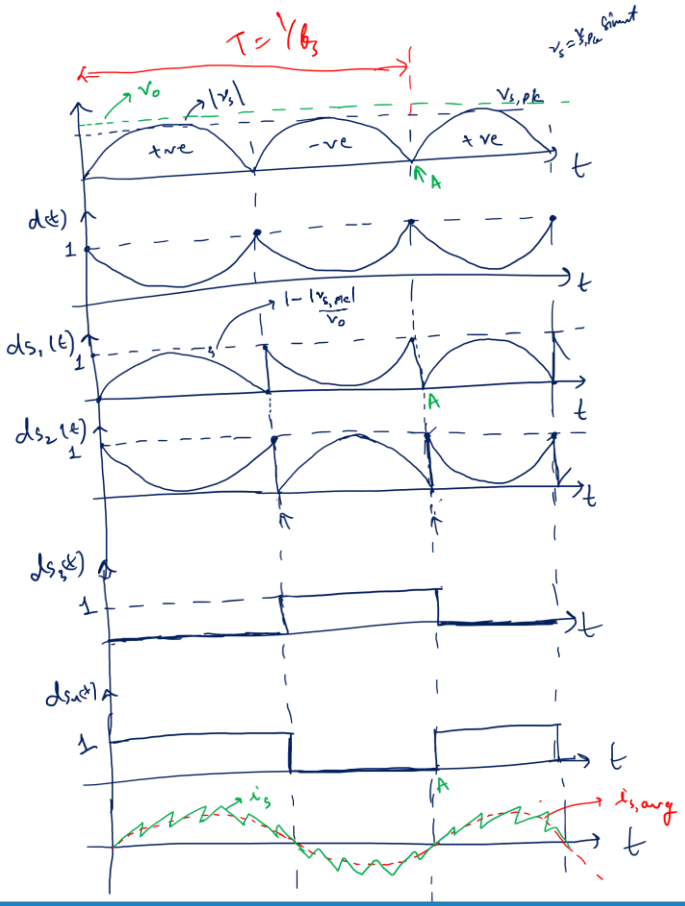


$$d_{s_1}(t) = 1 - d(t), \quad v_s > 0$$
$$= d(t), \quad v_s < 0$$

$$d_{s_2}(t) = 1 - d(t), \quad v_s < 0$$
$$d(t), \quad v_s > 0$$

$$d_{s_3}(t) = 0, \quad v_s > 0$$
$$= 1, \quad v_s < 0$$

$$d_{s_4}(t) = 1, \quad v_s > 0$$
$$= 0, \quad v_s < 0$$



Scenario-1 (point A) (v_s → -ve to +ve)

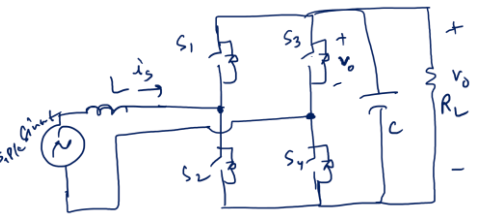
$ds_2 \rightarrow$ 0 to 1 → S_2 is ON

$ds_1 \rightarrow$ 1 to 0 → S_1 is off

If there is a delay in turning ON 'S_4' switch

$v_L = V_o$ (appearing across S_4 switch)

↳ there is a +ve spike in inductor current



Scenario-2 (point A) & (v_s → -ve to +ve)

if 'S_4' is ON ⇒ if S_2 is ON (for longer time duration)

$v_L \simeq 0$ (small quantity) → very small +ve positive slope

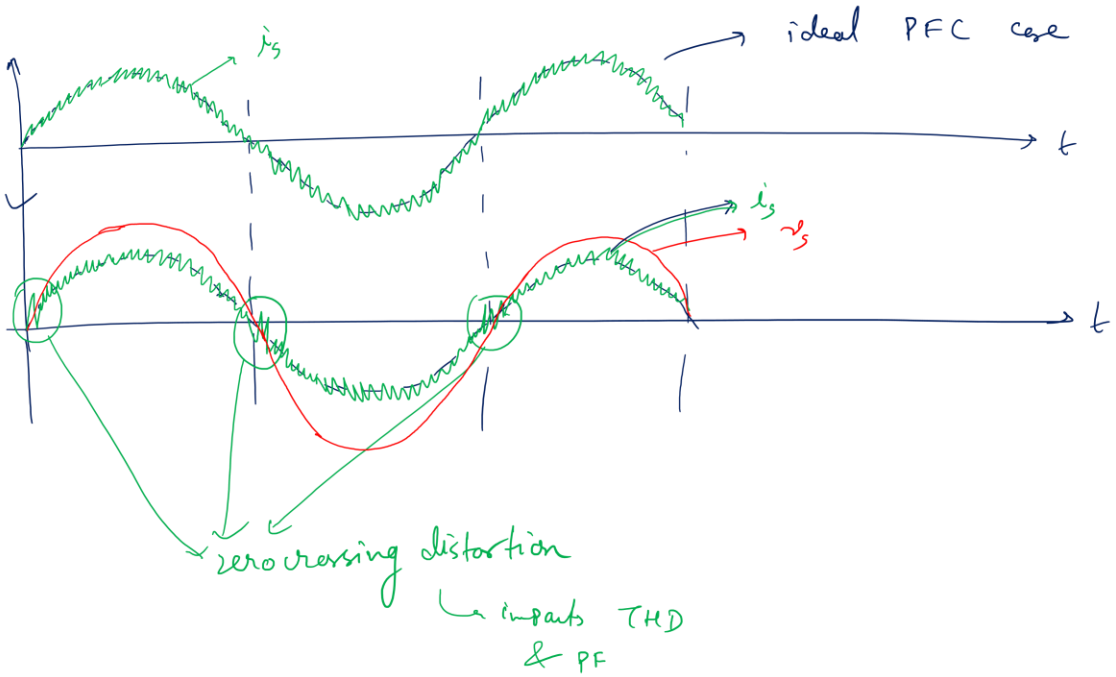
S_1 is ON for smaller duration

$v_L = v_s - V_o$

$v_s \rightarrow 0$

⇒ $v_L \rightarrow$ very large -ve quantity

⇒ there is -ve spike in inductor current


ideal PFC case
i_s
t
i_s
v_s
t
zero crossing distortion
↳ impacts THD
& PF

Thank You