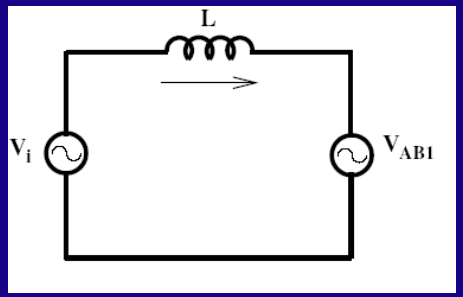
Review :

1) Device switching varies in S.M.R. with fixed hysteresis band current control.
2) Magnitude of reference current / D is determined by comparing the desired output voltage with actual V_0.

$\Rightarrow$ Closed loop control is a must.

3) D.C. link V_0 has 2^{nd} order ripple.
4) In bi-directional power converter, power can be controlled by controlling 'δ'.

$$P = \frac{V_i \, V_{AB1}}{X} \sin \delta.$$



OR Change the in-phase component of 'i_s' .

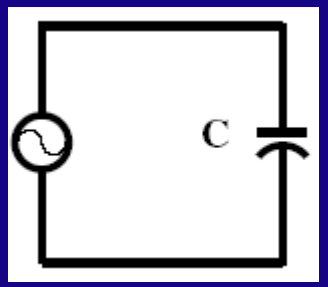
$\Rightarrow$ Control philosophy : Sense capacitor 'V' and control 'δ' or magnitude of 'i_s '.

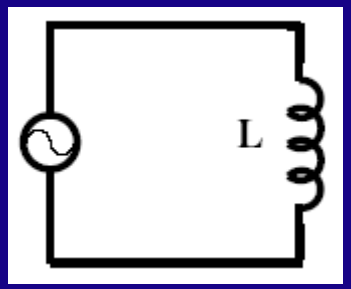
If V_i & V_{AB1} are in phase, $|V_i| \neq |V_{AB1}|$.

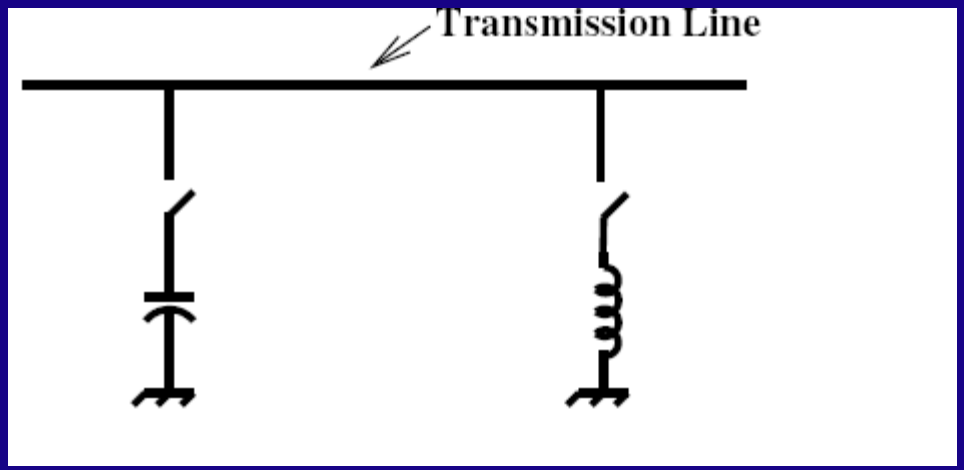
$\Rightarrow$ Active power transferred = 0.

$\Rightarrow$ If $|V_i| < |V_{AB1}|$, $\angle^{I_S}_{V_i}$ = 90° leading.

and if $|V_i| > |V_{AB1}|$, $\angle^{I_S}_{V_i}$ = 90° lagging.







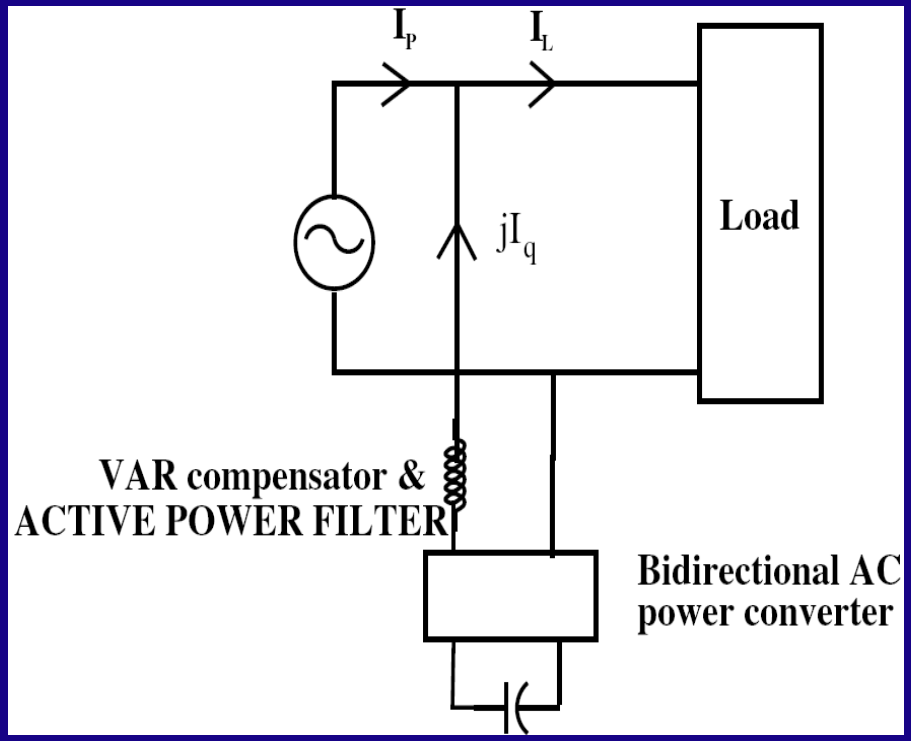
VAR Compensator & Harmonic Filter

$I_L = I_P - jI_Q$

Assume load to be Non – Linear

⇒ Has harmonics

⇒ Source is made to supply only the ACTIVE COMPONENT.



⇒ Remaining current has to come from P.E. converter.

In the previous case

(only S_4 is closed in the +ve half),

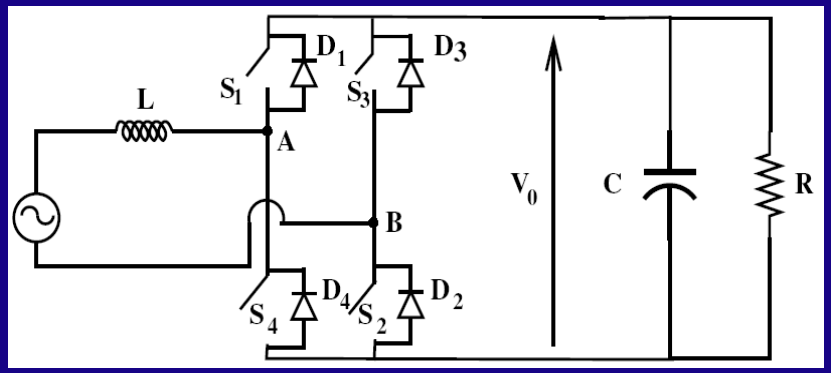
Near the Zero crossings,

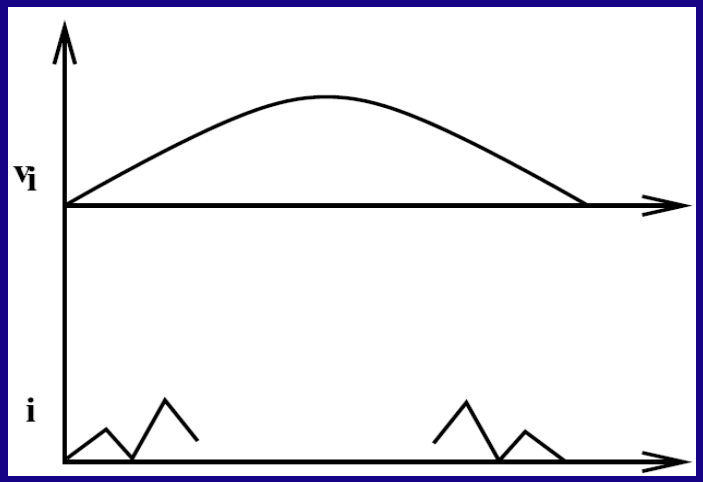
v_i is low

$$\frac{di}{dt} = \frac{v_i}{L}$$

$\Rightarrow$ Forcing function is low.

$\Rightarrow$ It may be difficult to force the current.

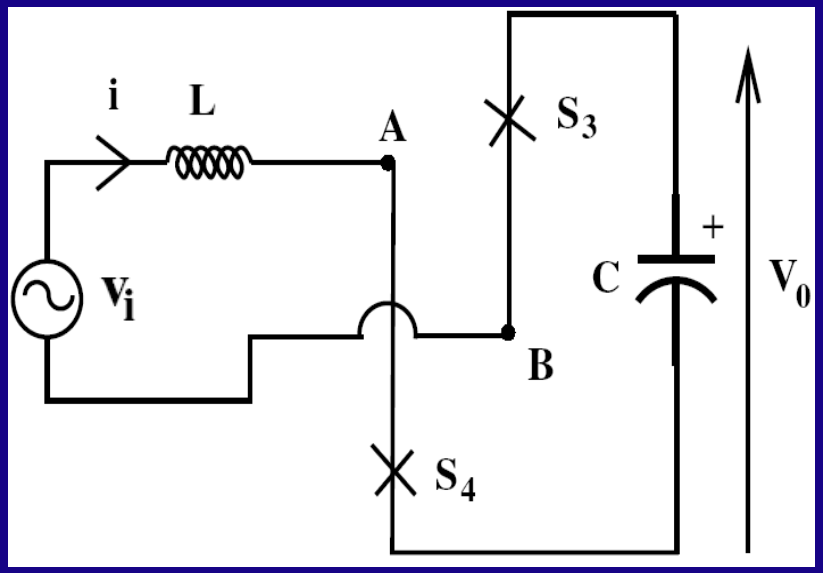




Instead :

In the + ve half, close S_4 & S_3

$$\frac{di}{dt} = \frac{v_i + v_0}{L} \quad \& \quad V_{AB} = -V_0$$



⇒ Capacitor voltage aids the current rise.

⇒ Current waveform improves.

⇒ Switching frequency increases if current control is used.

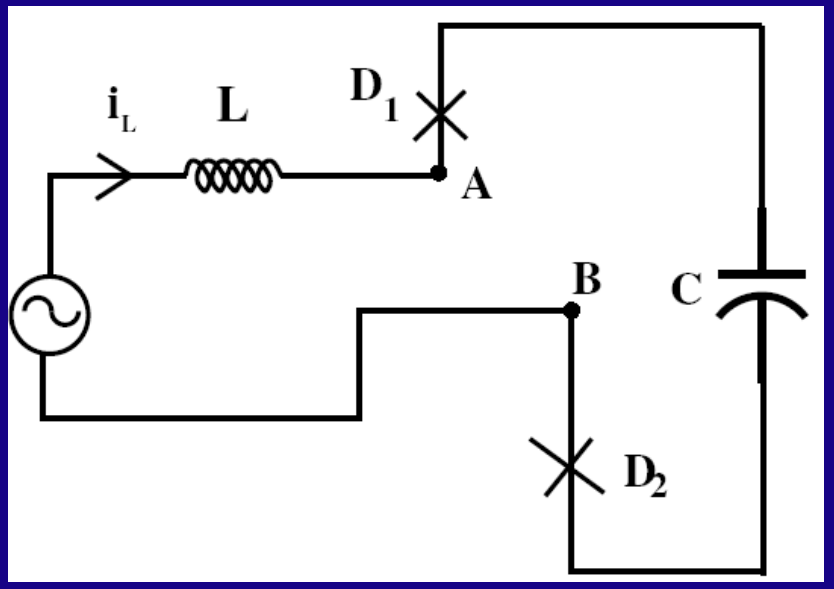
$\Rightarrow$ Open S_1 & S_3 :

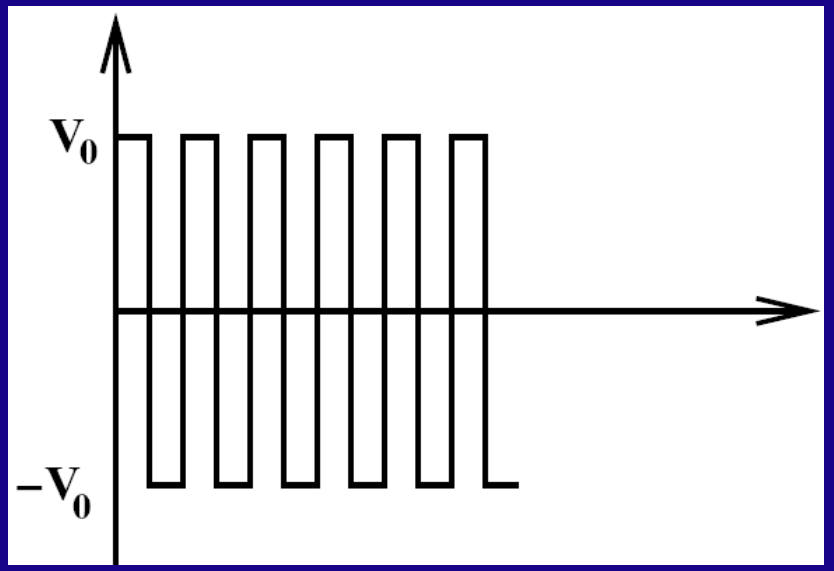
EQ. CKT.

$V_{AB} = V_0$

In the – ve half

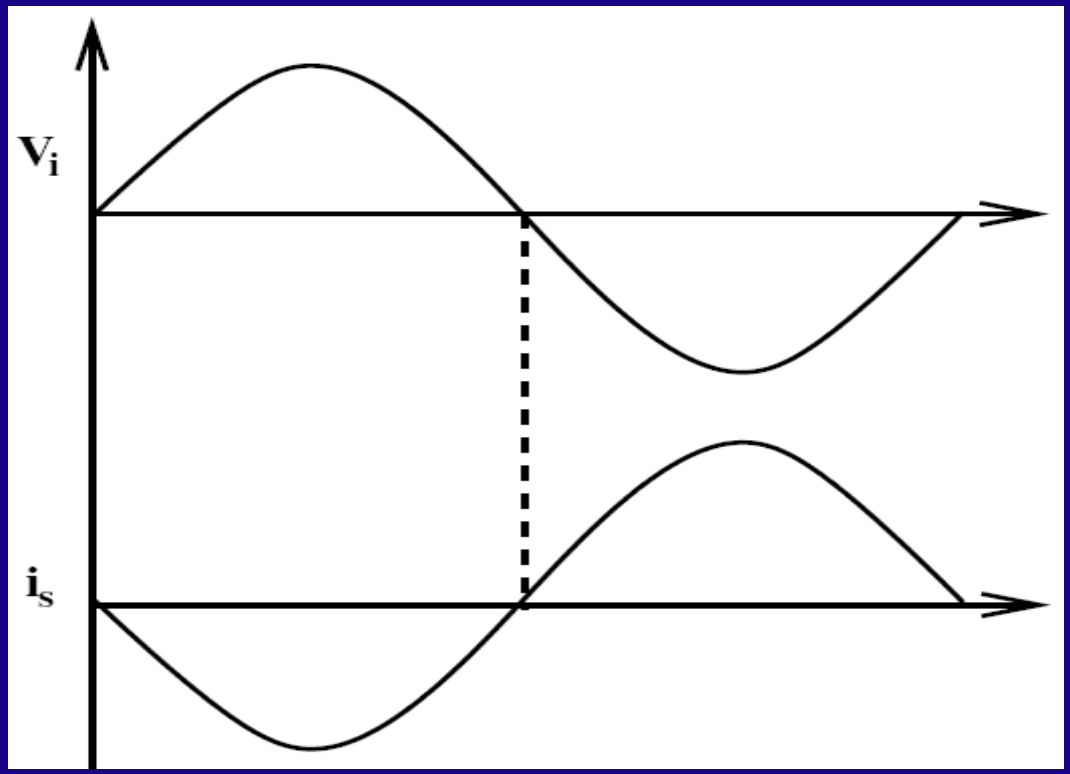
Close S_1 & S_2

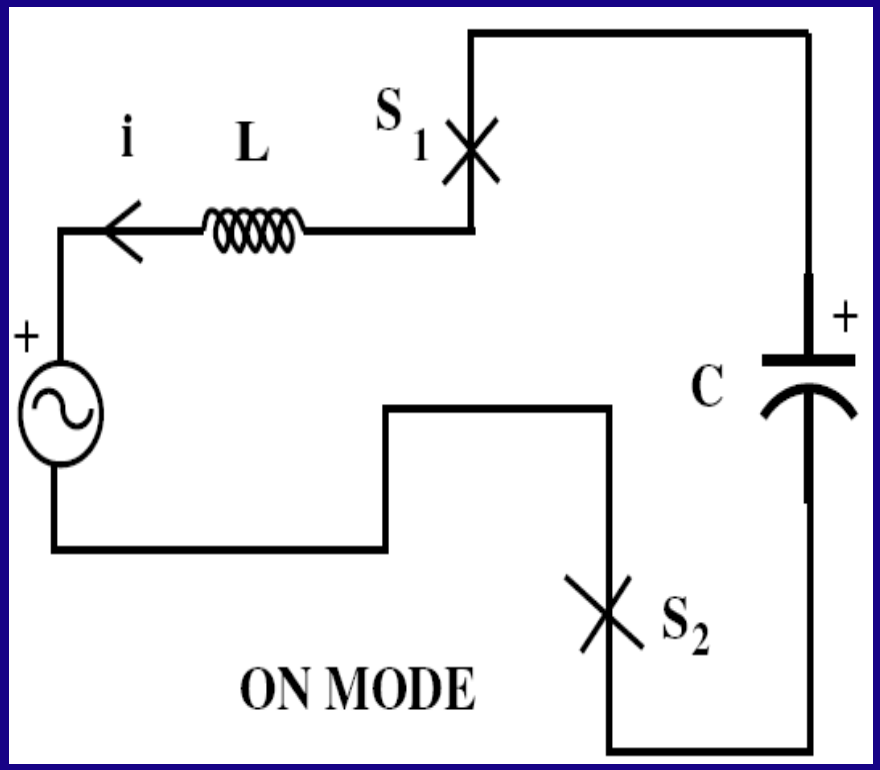


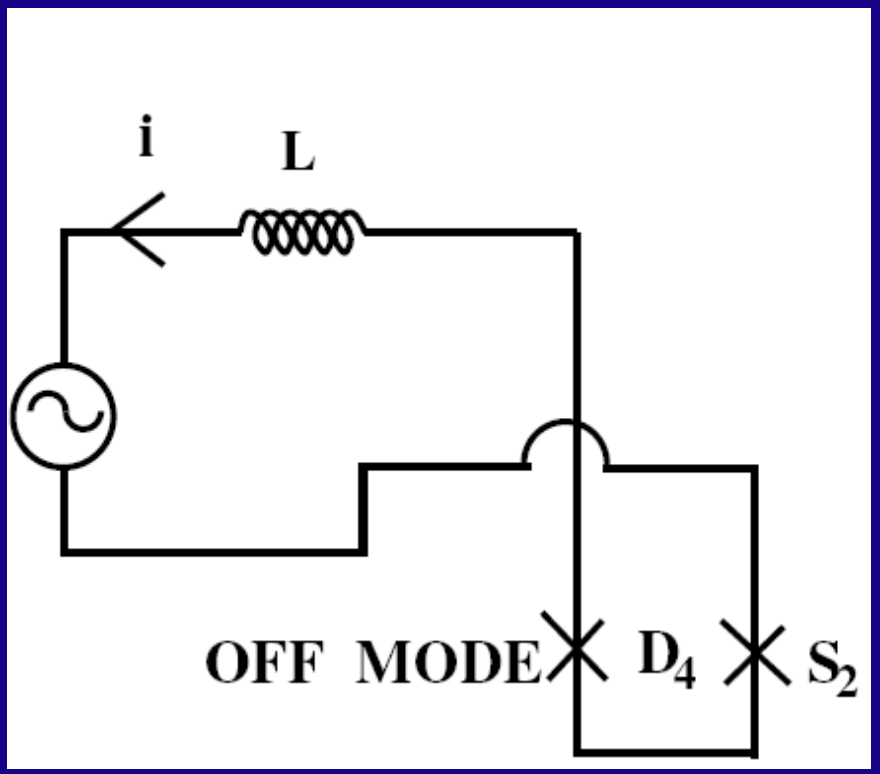


Regenerative mode :

Source is receiving power at UPF.




i
L
S 1
+
+
C
S2
ON MODE


i
L
OFF MODE
D4
S2

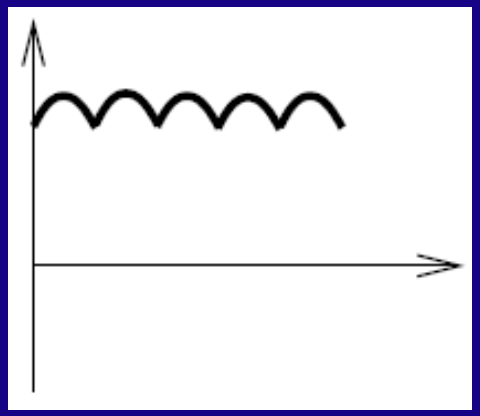
Summary of AC/DC conversion :

1) a. Half wave

b.Half controlled

c. Fully controlled

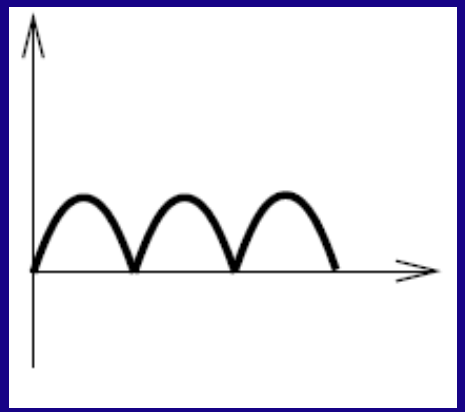
P.F. & Harmonic Spectrum are poor.



$\Rightarrow$ Only 1pulse of current / $\frac{1}{2}$ cycle.

V_0 Ripple frequency $= 2F$ for 1ϕ Bridge.

$= 6F$ for 3ϕ Bridge.



Filtering requirement for $V_0 \downarrow$ in 3ϕ.

2)PWM Converter :

$V_0 \propto m_i$ & $|V_0| < |V_m|$

$\Rightarrow$Has large number of pulses in V_0 & I_s.

3) S.M.R (Switched Mode Rectifier) :

$|V_0| > |V_m|$

Source I ≈ Sinusoidal.

P.F. ≈ 1

4) Bi – Directional Power Transfer :

Using bridge with self commutating devices

⇒ Bi – Directional power transfer at UPF.

⇒ ± VAR supply to the load.

⇒ Active filtering.