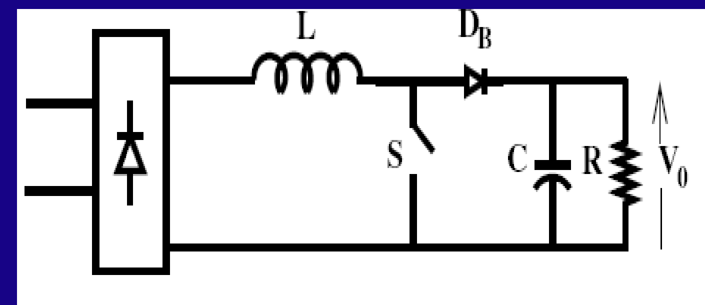
<u>Review :</u>

At steady state, $V_0 > V_m$

If $V_0 < V_m$, i_L will $\uparrow$, even when 'S' is opened.

$$\frac{di_L}{dt} = \frac{(V_{01} - V_0)}{L}$$; peak of $V_{01} = V_m$



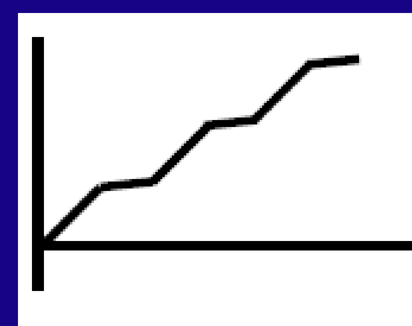
$\Rightarrow$ If 'S' is closed at $t = 0^+$

i_L and $\therefore$ i_S goes on $\uparrow$.

When $V_0 > V_{01}$, i_L starts $\downarrow$.

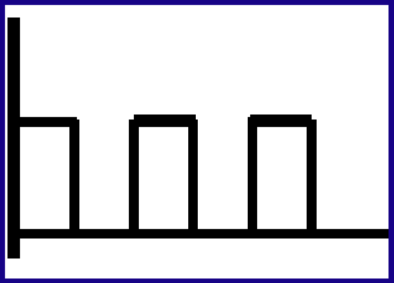
'V' rating of 'S' or $D_B > V_0$

Switching time of $D_B \approx$ that of 'S'



In fixed 'D' control,

$i_P \propto$ instantaneous value of v_{01}

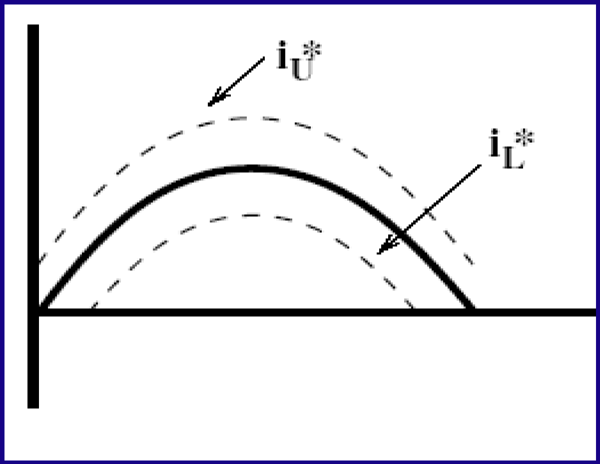


D $\rightarrow$ i_L is just continuous at $\omega t \approx \dfrac{\pi}{2}$

High frequency components of i_S can be filtered out using a small filter.

P.F. $\approx$ 1.

$\Rightarrow$ Switching F is constant.

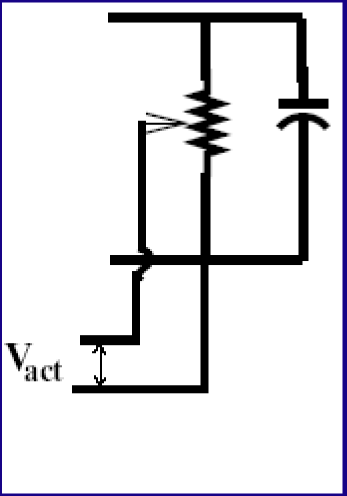


In current control, $i_L^* \leq i_L \leq i_U^*$

Smaller the band, Higher the switching frequency.

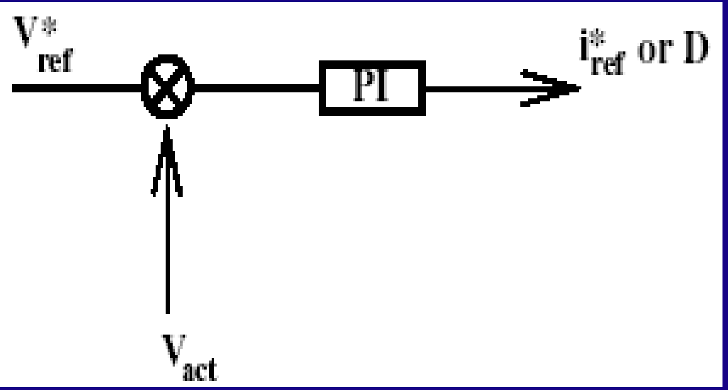
$\Rightarrow$ Waveform is superior.

How to choose the magnitude of i^*_{ref} or D:



- $\Rightarrow$ At the output side if V_0 is constant.
- $\Rightarrow$ Power supplied by the source = Power consumed by the load.
- $\Rightarrow$ Input power = $VI\cos\theta$, $\cos\theta \approx 1$
- $\Rightarrow$ If $V_0 \uparrow$ above the set value, decrease magnitude of i^*_{ref}.

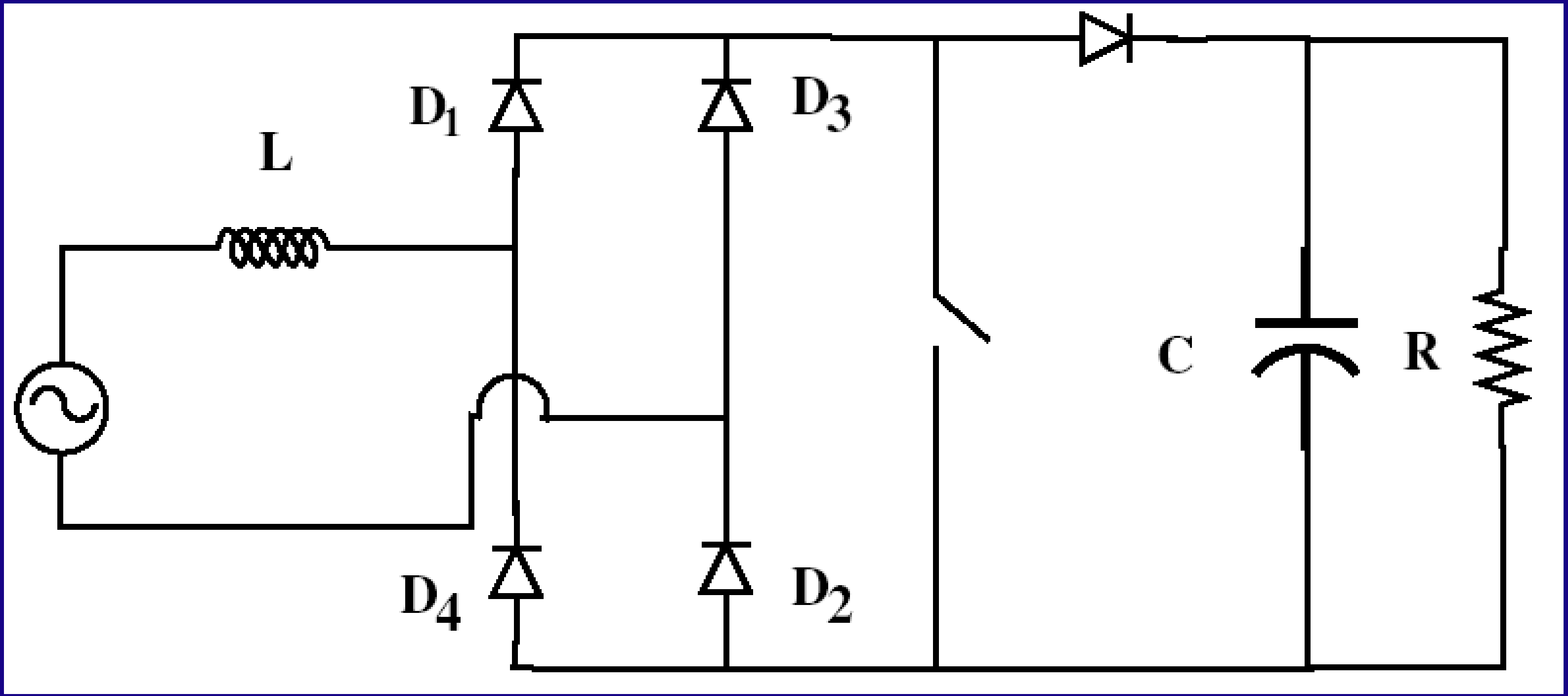
OR If $V_0 \downarrow$ below the set limit, increase magnitude of i^*_{ref}.



Inductor on AC side:

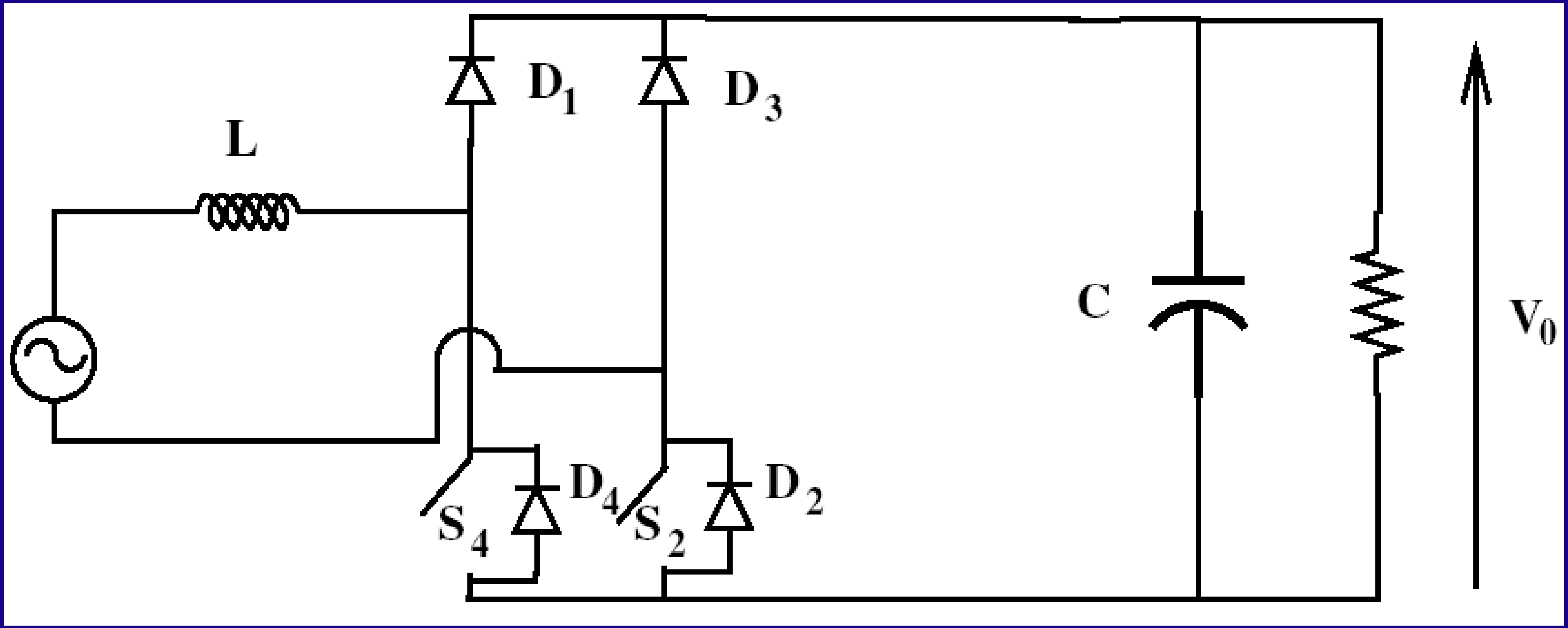
Principle of operation is the same.

$\Rightarrow$ Better utilization of iron (both halves of hysteresis loop).



Case 3:

With two switching devices.



In the +ve half:

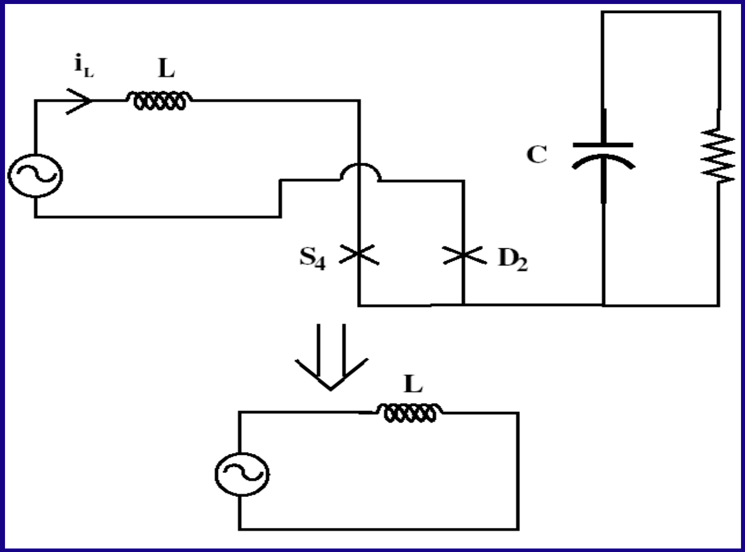
At a particular instant, close 'S_4 '.

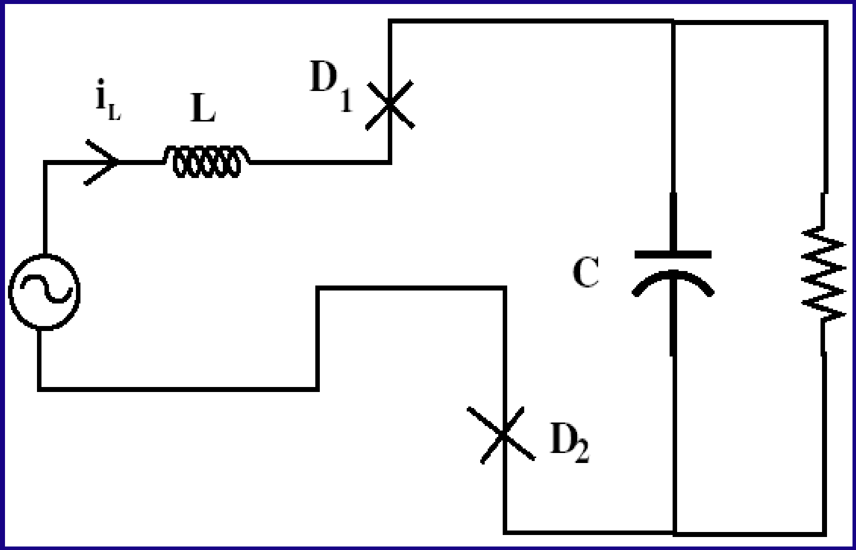
i_L ↑ linearly.

'C' supplies power to the load.

Depending upon the switching strategy, open 'S_4'.

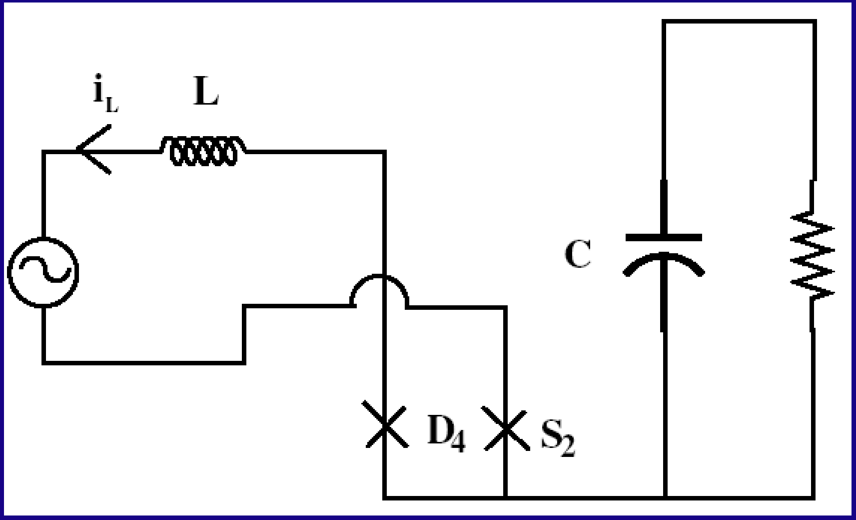
The stored energy is now transferred to the load.

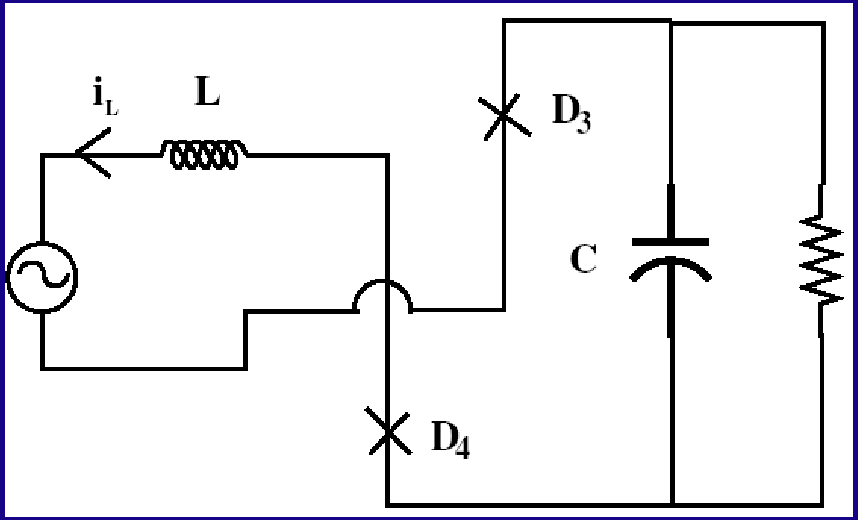




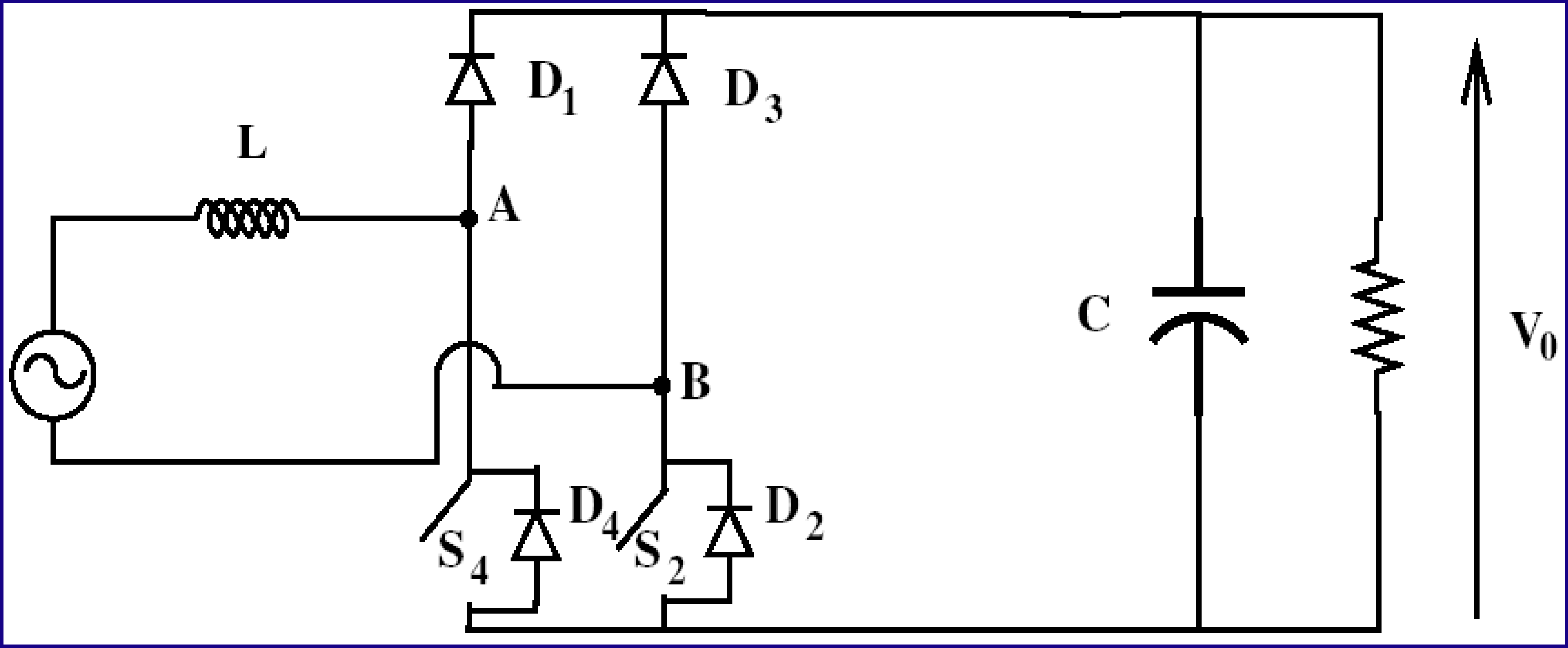
In the -ve half:

Close 'S_2' to ↑ $|i_L|$ and open 'S_2' to ↓ $|i_L|$





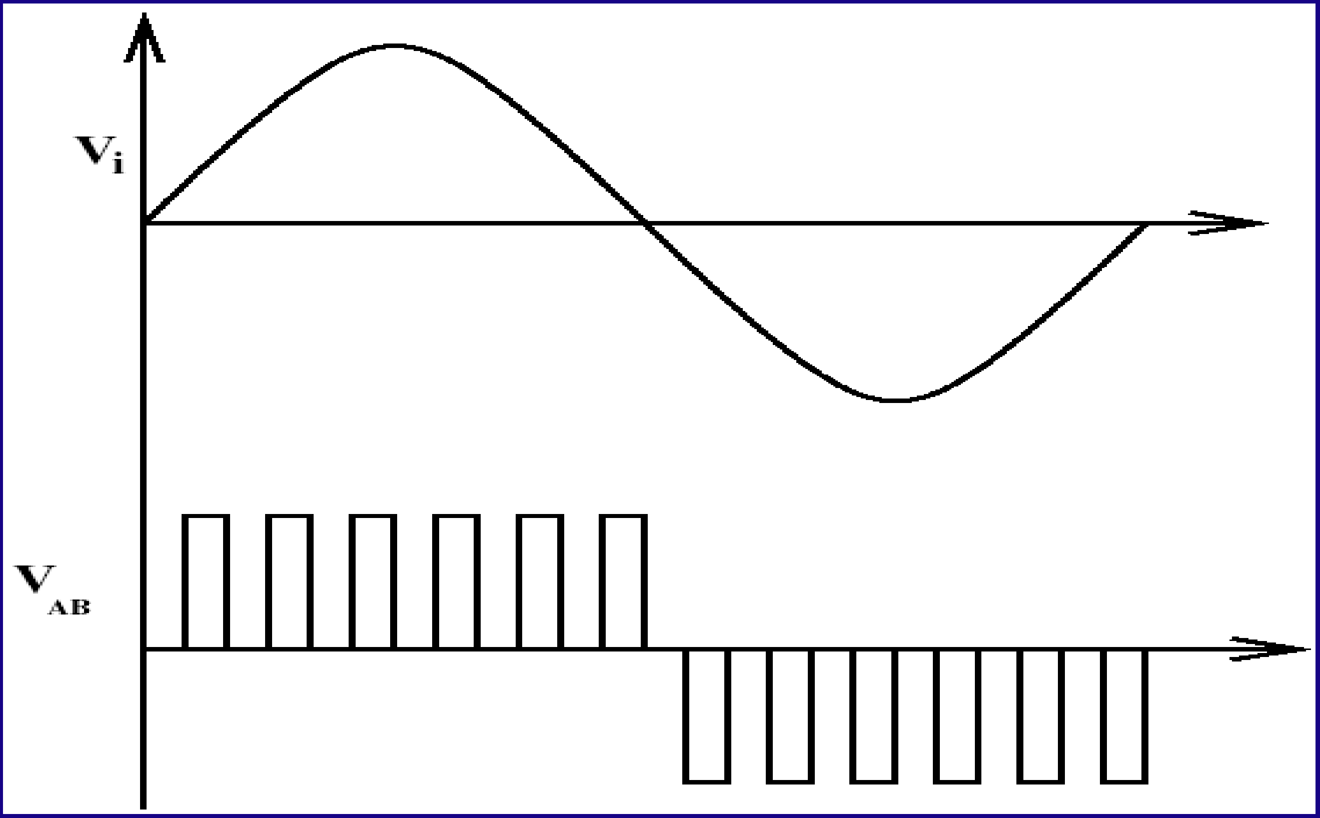
What sort of waveform across AB:



In the + ve half

1) When S_4 is closed: $V_{AB} = 0$

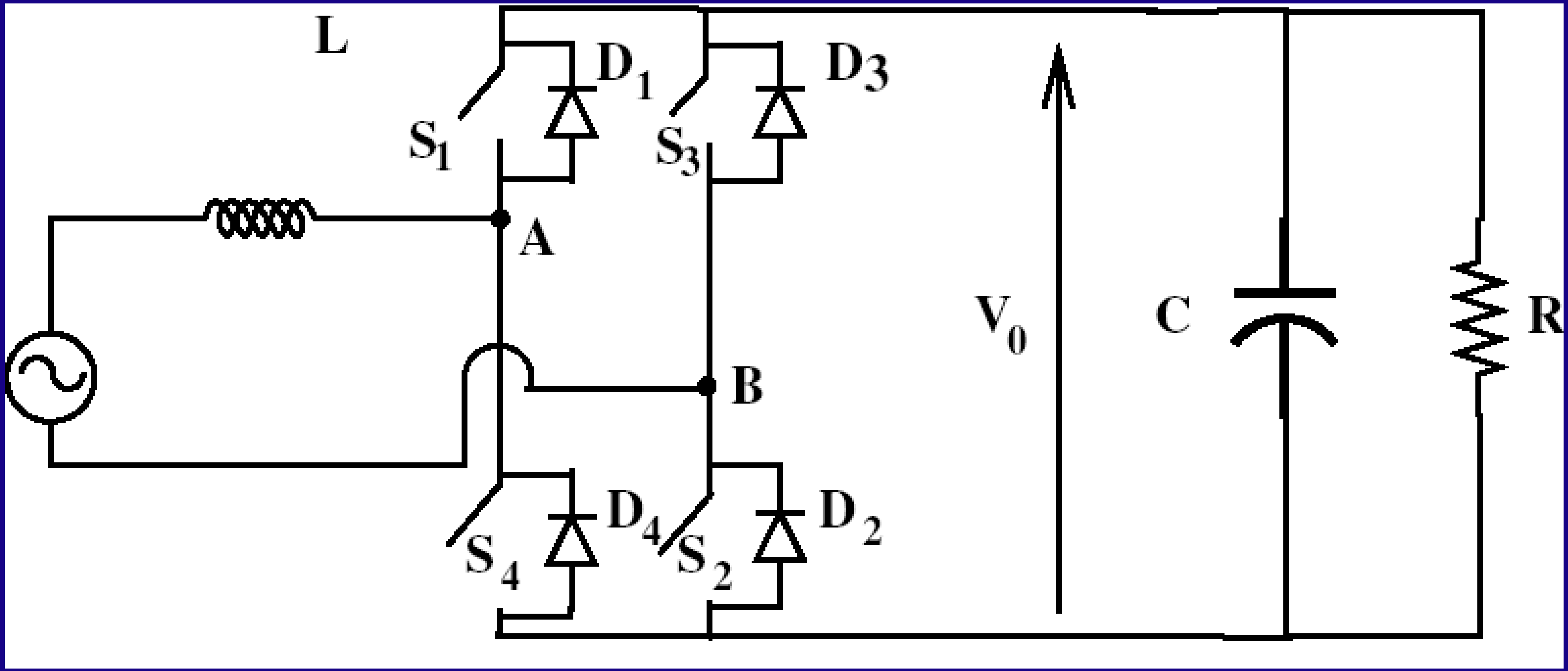
2) When S_4 is open: $V_{AB} = V_0$

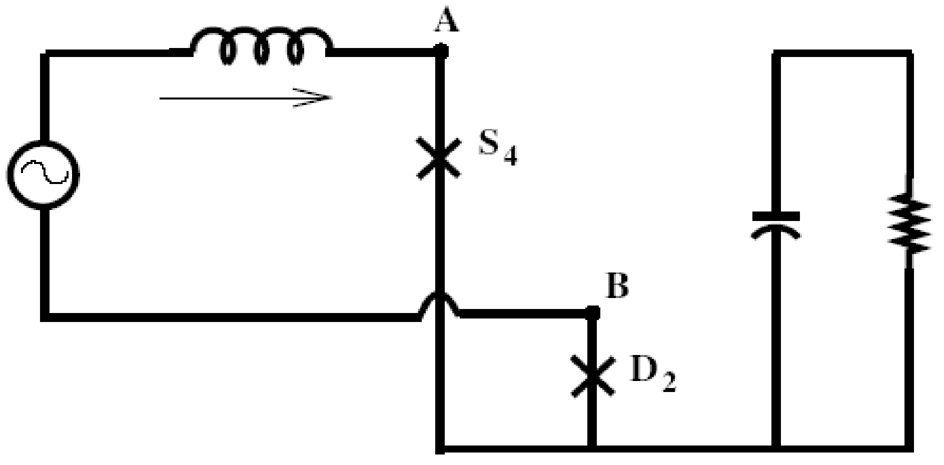


Bi – Directional Power Transfer:

$\Rightarrow$ 2 quadrant converter

('V' is +ve and 'I' can be +ve or -ve)





In the +ve half:

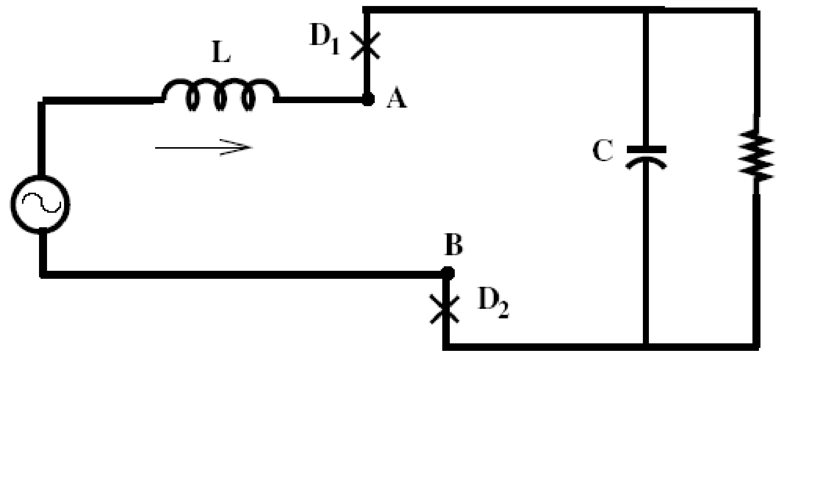
At a particular instant,

close 'S_2' as

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

Capacitor supplies power to the load.

$V_{AB} = 0$



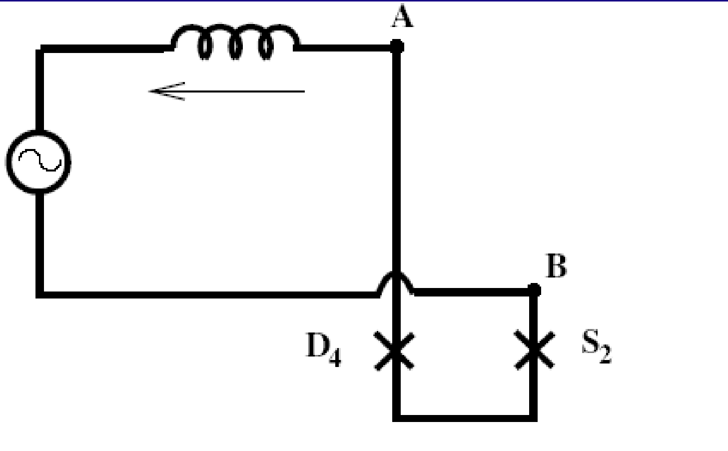
Open S_2 :

Stored energy is transferred

to the load through D_1D_2

$V_{AB} = V_0$

Similarly in the -ve half:

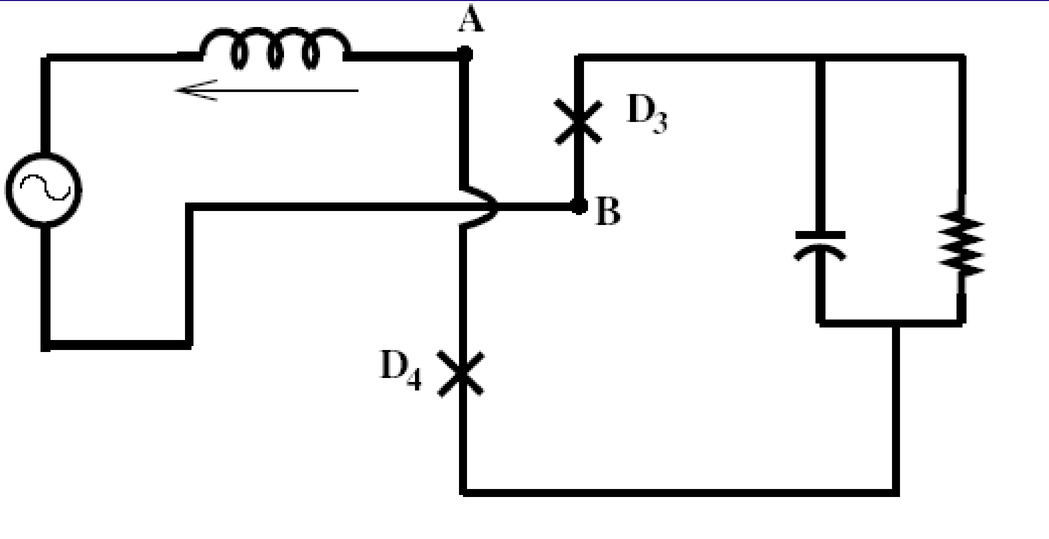


Close 'S_2'.

$V_{AB} = 0$

After a while, open 'S_2'

$V_{AB} = -V_0$

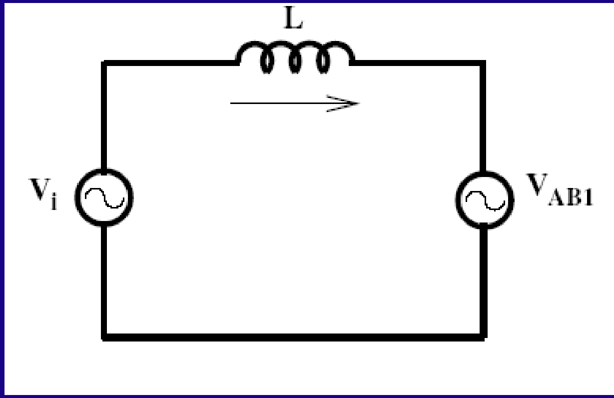


$\therefore$ Power transfer from source to

the load = $\dfrac{V_i \, V_{AB1}}{\omega L} \sin \delta$,

where $\omega = 2\pi F$ and

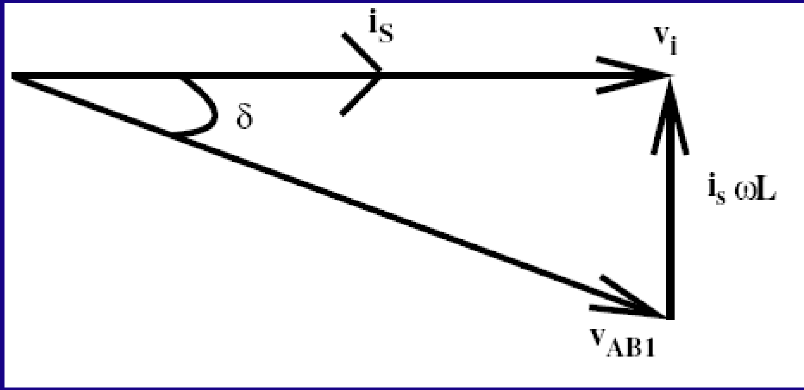
$F \rightarrow$ frequency of v_i

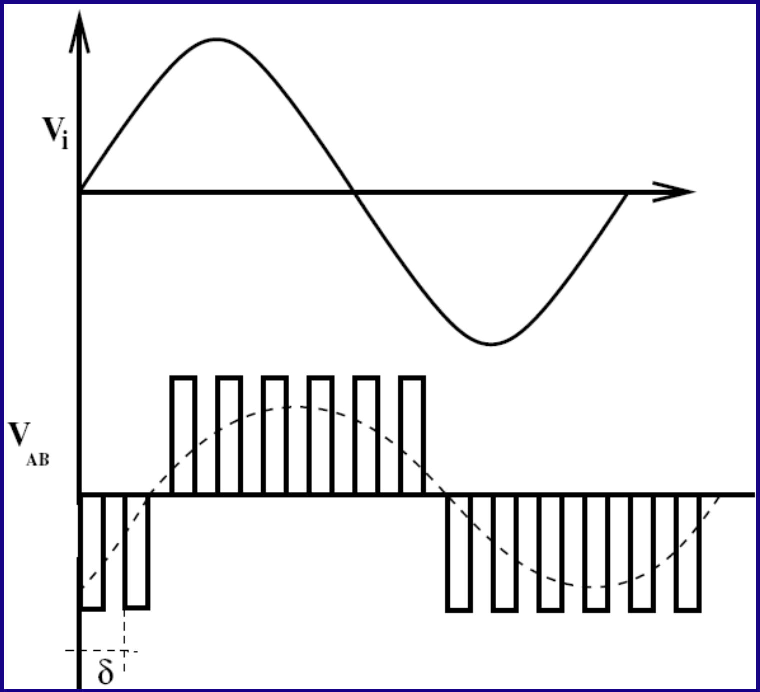


If $\delta = 0$ and $|V_S| \neq |V_{AB1}|$

Power transfer to the load is = 0.

$\because$ $|V_S| \neq |V_{AB1}|$, i_S will flow





If $|V_S| < |V_{AB1}|$, $\angle_{V_S}^{i_S}$ = 90° leading

$\Rightarrow$ Capacitor

If $|V_S| > |V_{AB1}|$, $\angle_{V_S}^{i_S}$ = 90° lagging

$\Rightarrow$ Inductor

$\Rightarrow$ Can be used to improve the P.F. both supplying $\pm$VARs