Why do we require variable DC supply

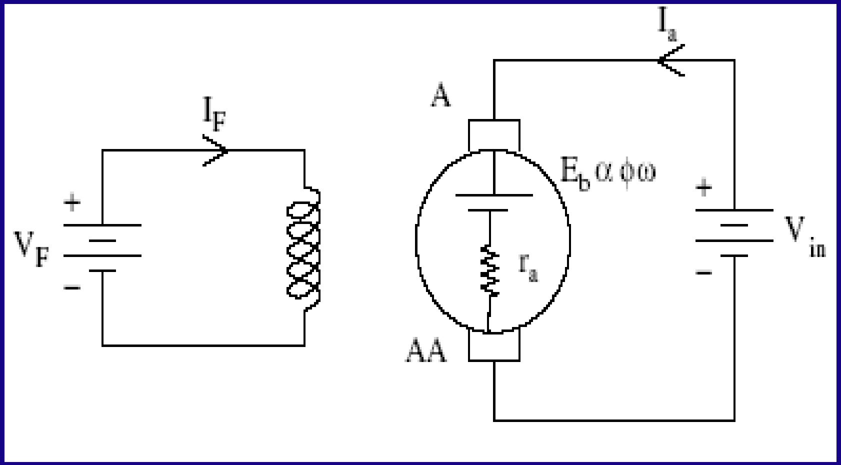
$V_{in} = E_b + I_a r_a$

$E_b = k\phi\omega = kI_F\omega$

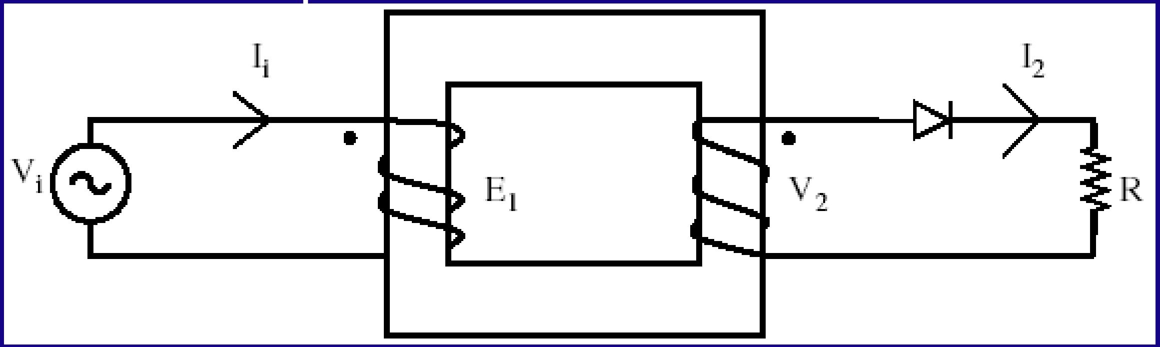
$\therefore \omega = \dfrac{V}{kI_F} - \dfrac{I_a r_a}{kI_F}$

$\omega \propto V_{in}$

$\propto 1/I_F$ **Both requires variable DC supply**



Input 'V_i' is sinusoidal



$\Rightarrow$ E_1 & V_2 are Sinusoidal.

$\Rightarrow$ i_2 is non-sinusoidal.

$\Rightarrow$ Core flux can have a DC component in addition to a sinusoidal component.

Pri. AT=Sec. AT

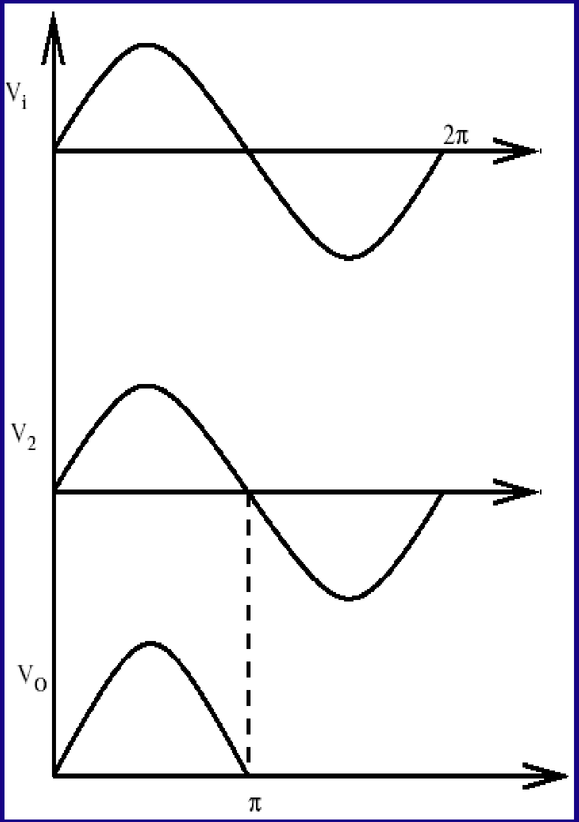
(Neglecting magnetizing Current)

Fourier Spectrum=DC component

+x sin ωt

+Higher 'ω' terms

For high frequency AC component in secondary there should be a high frequency component in primary.



⇒ No DC in primary.

Flux in the core has

a DC component.

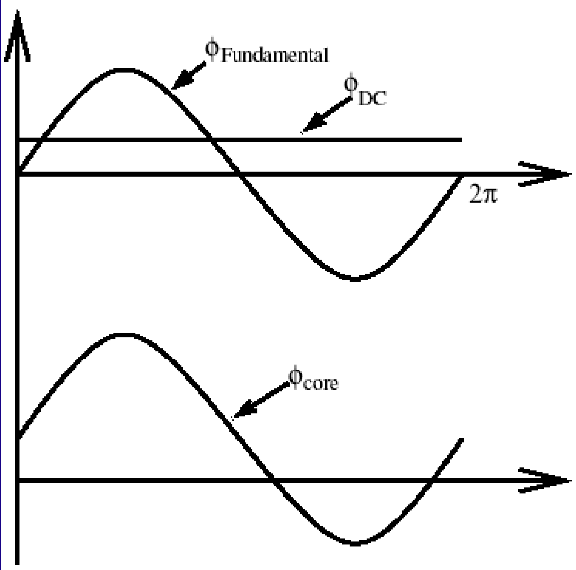
⇒ Core may get saturated

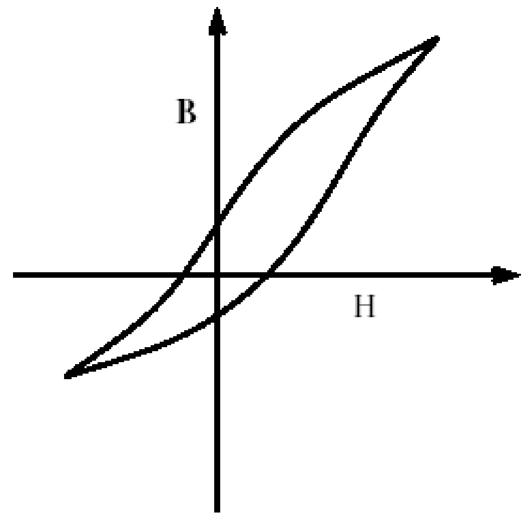
during some part of the

cycle.

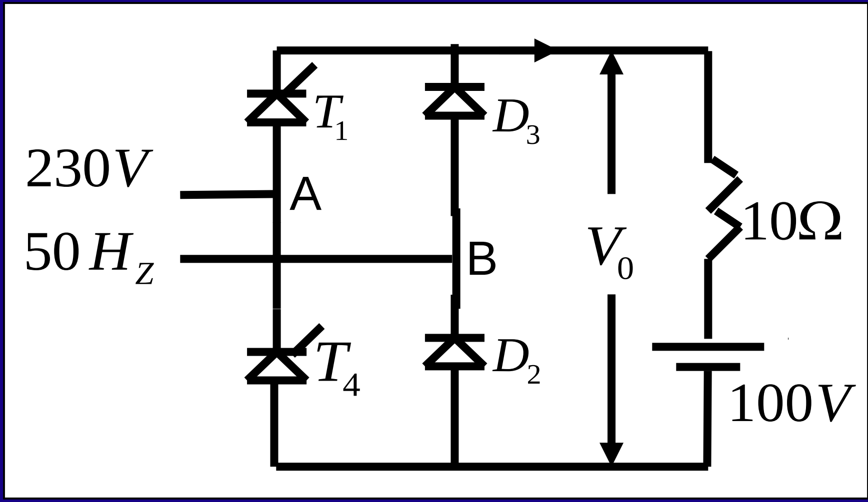
⇒ i will be peaky, core loss

& harmonics.





2. For the circuit shown in fig. determine average value of load current for $\alpha = 60^0$

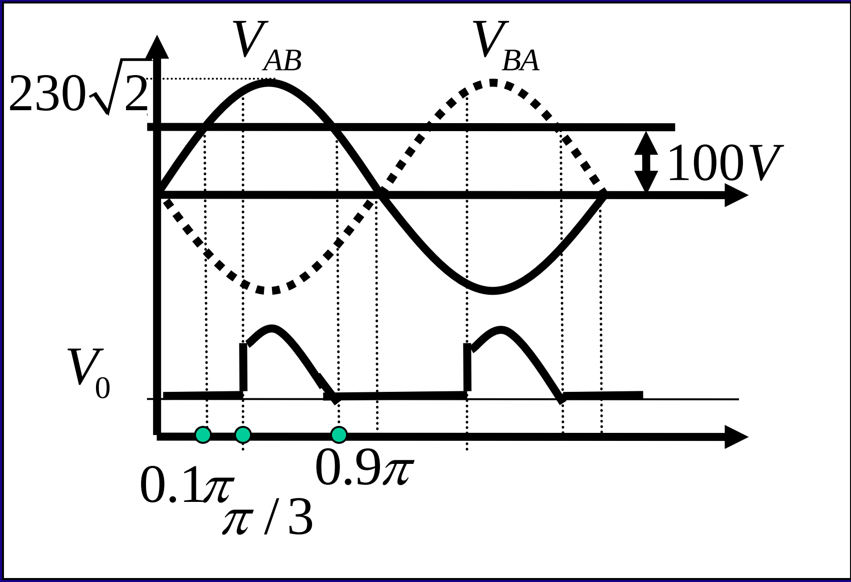


What is the new value of average current flowing through load if a large 'L' is connected in series with the load

Neglect the device drop

a) R-E Load:

$$\alpha_{\min} = \sin^{-1}\left(\frac{100}{230 * \sqrt{2}}\right) = 18^0 = 0.1\pi^c$$



Minimum value of α can be 18^0

But it is triggered at 60^0

It will turn off $= \pi - \alpha_{\min} = 162^0$

$\Rightarrow 0 \ to \ 60^0 \ :- \qquad V_0 = E$

$60^0 \ to \ 162^0 \ :- \quad V_0 = V_m \ Sin\,\omega t$

$162^0 \ to \ 360 \ :- \quad V_0 = E$

$\therefore$ Av. line voltage

$$= \frac{1}{\pi}\left[\int_0^{\pi/3} E d\omega t + \int_{\pi/3}^{0.9\pi} V_m Sin\,\omega t\, d\omega t + \int_{0.9\pi}^{\pi} E\, d\omega t\right]$$

$= 193.45\ V$

$\therefore$ Av. value of load current $I_{av} = \dfrac{193.45 - 100}{10} = 9.345A$

b **With large inductance in series with the load current becomes continious.**

$$\alpha = 60^0$$

$$\text{Av. value of o/p } Voltage = \frac{230\sqrt{2}}{\pi}(1 + Cos\alpha)$$

$$= 155\ V$$

$$Av.value\ of\ I = \frac{155 - 100}{10} = 5.5A$$

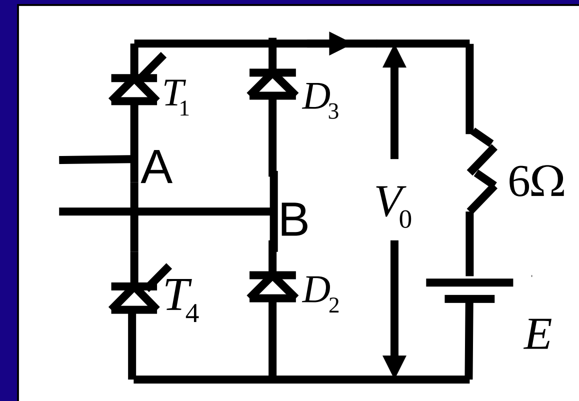
3.Av. value of $I_L = 1.8A$

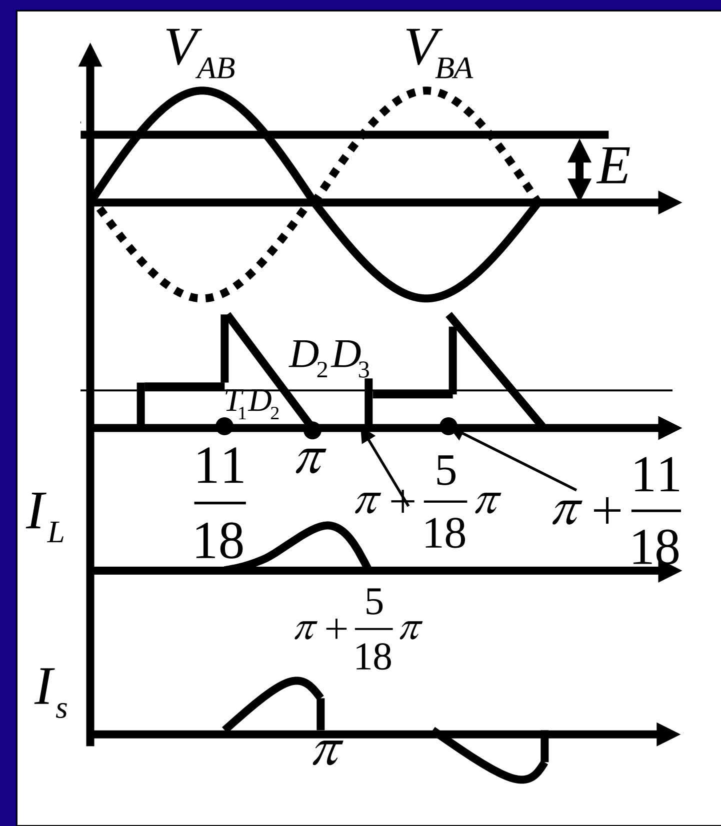
Triggering angle is maintained at 110^0

current becomes zero at 50^0 beyond the zero crossing.

Sketch the load current and applied average voltage waveform.

$$\alpha_{\min} = Sin^{-1}\left[\frac{E}{V_m}\right]$$





From $\frac{11}{18}$ to π radian T_1 & D_2 conduct

$$V_0 = V_i$$

From π to $\left(\pi + \frac{5}{18}\pi\right)$

$V_0 = 0 \because D_2 \,\&\, D_3$ conducting

$$V_{av} = \frac{1}{\pi}\left[\int_{\frac{11\pi}{18}}^{\pi} V_m Sin\omega t \, d\omega t + \int_{\pi}^{\pi+\frac{5\pi}{18}} 0 \, d\omega t + \int_{\pi+\frac{5\pi}{18}}^{\pi+\frac{11\pi}{18}} E \, d\omega t\right]$$

$$= \frac{1}{\pi}\left[230\sqrt{2}\left(Cos\frac{11\pi}{18}+1\right)+\frac{\pi}{3}E\right]$$

$$\therefore V_{av} = 68.12 + \frac{E}{3}$$

$$\therefore I_{av} = \frac{V_{av} - E}{R}, \quad I_{av} = 1.8A, R = 6\Omega$$

$$\therefore E = 85.9V$$