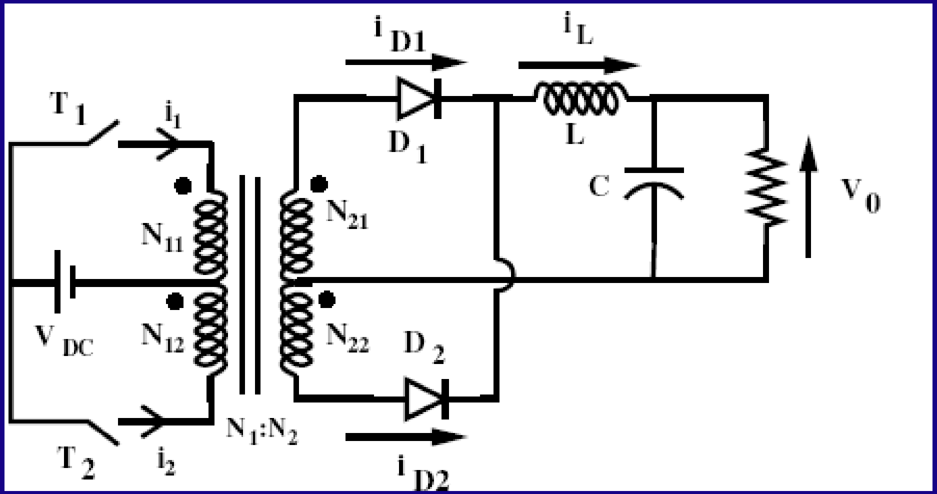
Push – Pull converter :

$$N_{11} = N_{12} = \frac{N_1}{2}$$

$$N_{21} = N_{22} = \frac{N_2}{2}$$



From $t = 0$ to $t = DT/2$, T_1 is ON & T_2 is OFF

$t = DT/2$ to $t = T/2$, T_1 & T_2 are OFF

$t = T/2$ to $t = (1+D)T/2$, T_2 is ON & T_1 is OFF

$t = (1+D)T/2$ to $t = T$, T_1 & T_2 are OFF

From $0 < t < DT/2$ $\quad T_1$ is ON

$'V'$ across $N_{11} = V_{11} = V_{DC}$ (with '•' as +ve)

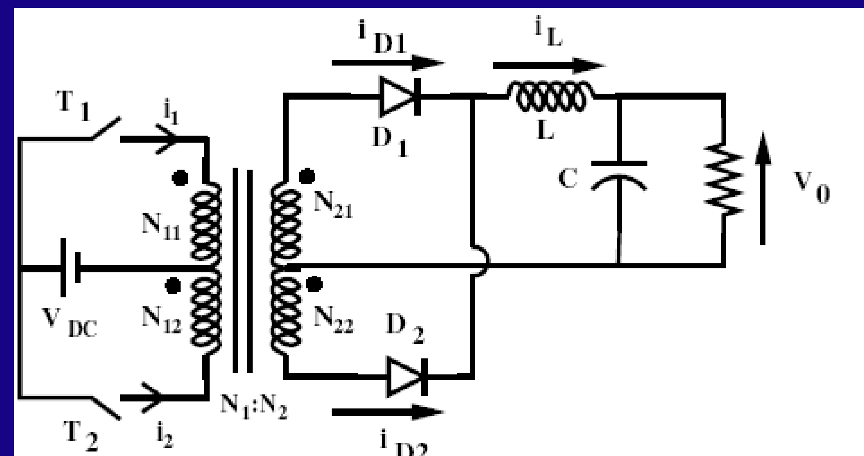
$'V'$ across $N_{12} = V_{12} = V_{DC}$

$'V'$ across $T_2 = 2V_{DC}$

i_1 enters the DOT

i_{D1} can leave the DOT $= i_L$

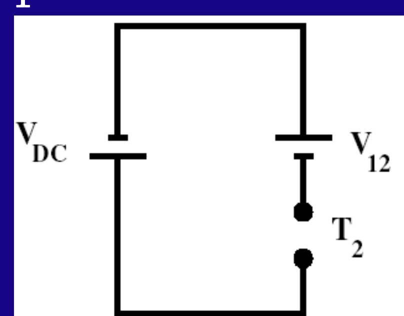
$i_{D2} = 0$

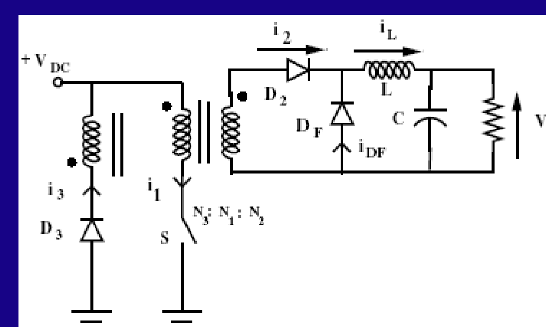


$'V'$ across $N_{21} = V_{21} = V_{DC}\dfrac{N_2}{N_1} = 'V'$ across N_{22}

'D_2' is off

$\therefore 'V'$ across $D_2 = 2V_{DC}\dfrac{N_2}{N_1}$





i_{D2} enters the dot

$\Rightarrow i_{D1}$ can leave the dot

$\therefore$ If D_2 conducts D_1 will also conduct.

'V' across secondary = 0 (N_2 turns)

'V' across primary = 0 (N_1 turns)

$$N_{21}\frac{d\phi}{dt} - i_{D1}r = V_{01}$$

$$N_{22}\frac{d\phi}{dt} + i_{D2}r = -V_{01}$$

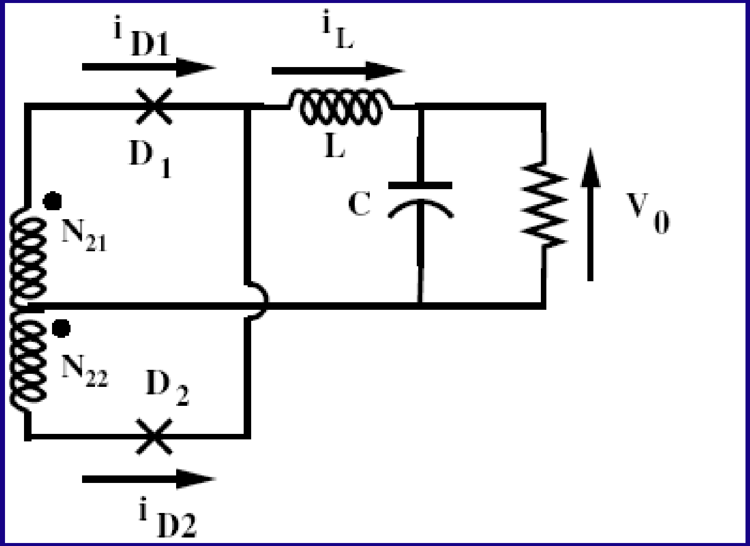
$$\therefore\ N_2\frac{d\phi}{dt} = -(i_{D2} - i_{D1})r, \qquad N_{21} = N_{22} = N_2/2$$

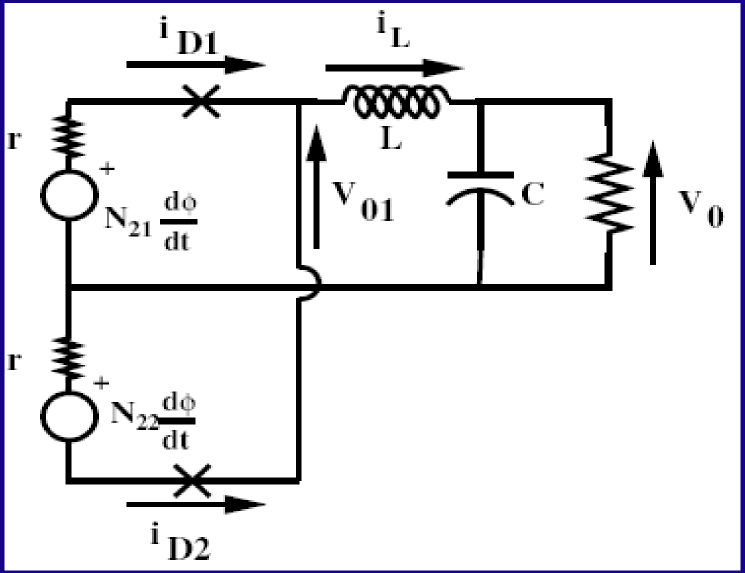
i_{D2} should be > i_{D1},

$i_{D1}\ ;\ i_{D2} = i_L/2$

$\Rightarrow V_{01}\ ;\ 0 \qquad \therefore\ V_L = -V_0,$

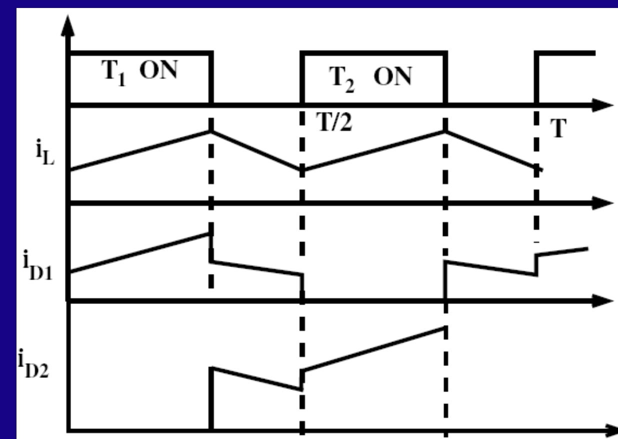
$\therefore$ av. 'V' across L $= 0$





$$V_0 = V_{Dc}\frac{N_2}{N_1}D, \quad D \rightarrow \text{ duty cycle of each switch} = \frac{T_{on}}{T_s/2}$$

$$V_0 = 2V_{Dc}\frac{N_2}{N_1}D, \quad D = \frac{T_{on}}{T_s}, 0 < D < 0.5$$

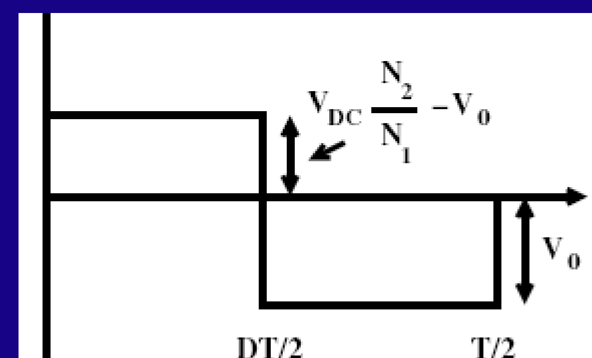


$$\underline{\text{at } T/2 < t < (1+D)T/2, \quad \text{close } T_2,}$$

$V_{12} = -V_{DC}$ (with '•' as −ve)

i_L flows through $\underline{D_2}$ & D_1 can not conduct

Open T_2 : Both D_1 & D_2 conduct



<u>Limitations of push – pull converter :</u>

In a practical circuit, two halves of push – pull converter are not the same

⇒ Primary winding may differ by a fraction of a turn

$\Rightarrow$ Switches may have slightly different saturation voltage

$\Rightarrow$ B – H curve is not traversed symmetrically

$\Rightarrow$ A dc flux in the core

$\Rightarrow$ Core imbalance

$\Rightarrow$ Flux walking to one direction

$\Rightarrow$ Sudden demand in load controller $\uparrow$ D to max. value

$\Rightarrow$ i & $\therefore$ H $\uparrow$

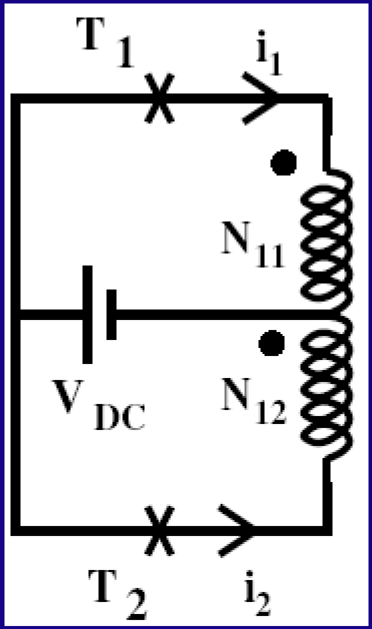
$\Rightarrow$ Core may saturate

$\Rightarrow$ Dead time between T_1 & T_2 :

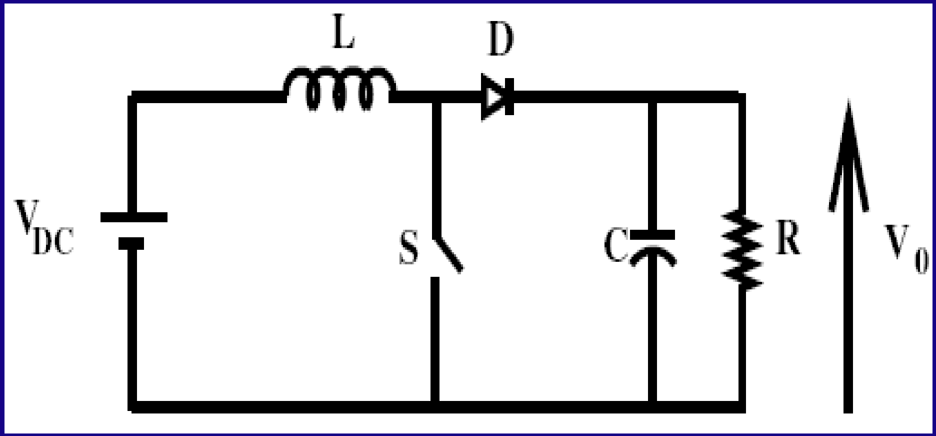
If both are ON flux produced by i_1 & i_2 opposes each other

$\Rightarrow$ If $L_1 = L_2 = M$

'i' in the core is limited by 'r'.



In 1960's $\rightarrow$ Linear Regulators
$\rightarrow$ Simple
$\rightarrow$ Low η

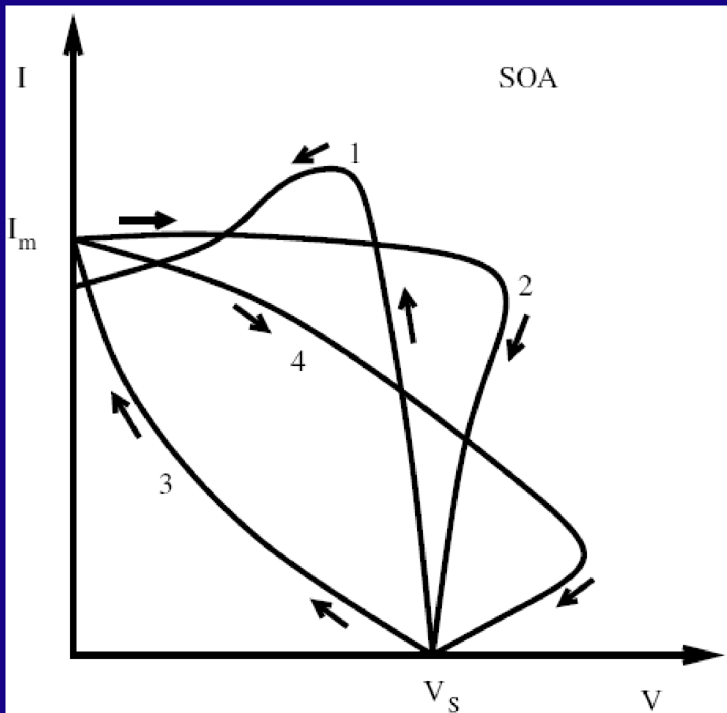


Switch Mode Conversion $\Rightarrow$ Vary 'D' (ON/T) to control 'V_0'
$\rightarrow$ P.W.M. Control

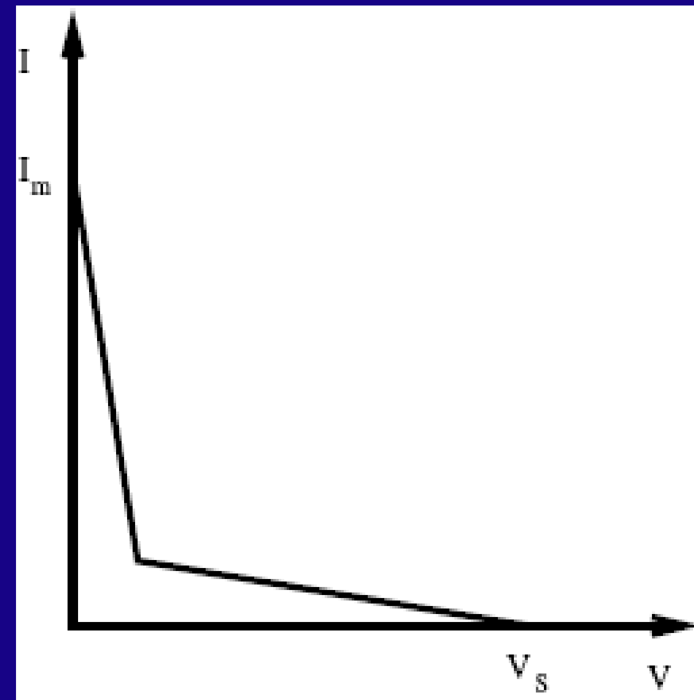
If 'i' is continuous, switches are required to turn ON/OFF the entire inductor 'i'.

$\Rightarrow \frac{di}{dt}$ & $\frac{dv}{dt}$ is very high

$\Rightarrow$ Hard Switching



Hard Switching



Soft Switching

	Turn-On	Turn-Off
Without Snubber	1	2
With Snubber	3	4

SOA : Safe Operating Area

V_s = Supply Voltage

I_m = Maximum Current