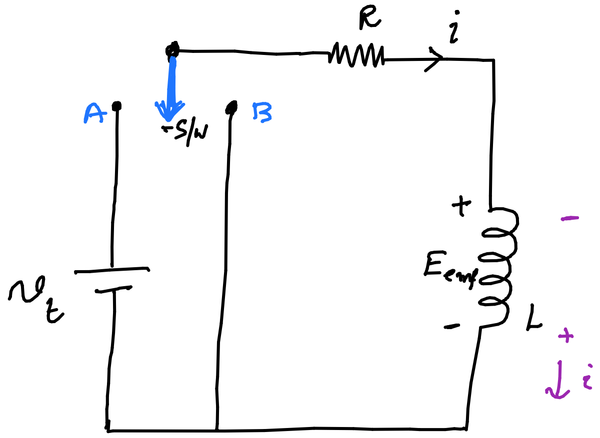


Connect S/W to pos^n A

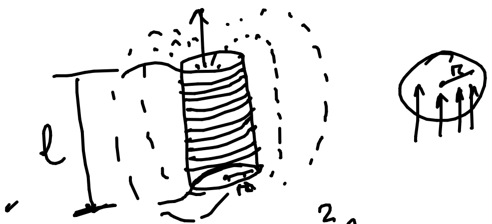
$t = 0^+$

E_{emf} in inductor

$$E_{emf} = -L\frac{di}{dt}$$

By skipping -ve sign

$$E_{emf} = -L\frac{di}{dt}$$



$$L = \frac{\mu_0 N^2 A}{l}$$

The power across inductor

$$P = E_{emf}\, i$$
$$= \left(L\frac{di}{dt}\right) i$$

$$p = \frac{dW}{dt}$$

$$\Rightarrow \underbrace{P\,dt}_{dW} = L\, i\, di$$

$$dW = L\, i\, di$$

Energy associated with the inductor

$$W = \int dW = L\int_0^{I_f} i\, di$$

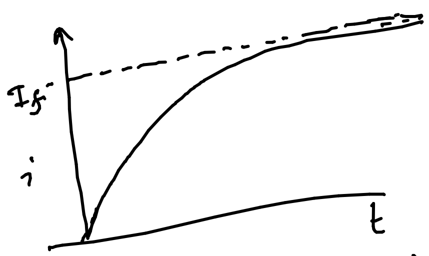
$$\boxed{\Rightarrow W = \frac{1}{2} L I_f^2}$$

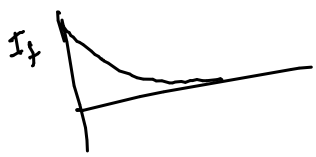
Amount of energy stored in inductors

or

Eenergy associated with magnetic field.

$$v_t = Ri + L\frac{di}{dt}$$
$$\downarrow$$
$$i(t) = \frac{v_t}{R}\left(1 - e^{-R/L\, t}\right)$$





$$v_t = iR + L\frac{di}{dt}$$

$$\underbrace{v_t i}_{P} = i^2R + Li\frac{di}{dt}$$

supply power

$$\Rightarrow P = i^2R + Li\frac{di}{dt}$$

$$\Rightarrow Pdt = i^2R\,dt + L\,i\,di$$

Total energy supplied W_s

$$\int_0^T P\,dt = i^2R\int_0^T dt + L\int_0^{I_f} i\,di$$

$$\Rightarrow \underline{\underline{W_s}} = \underbrace{i^2R\int_0^T dt}_{\text{heat energy}} + \underbrace{\frac{1}{2}LI_f^2}_{\text{stored in inductor}}$$

↓

energy associated with magnetic field.

The energy associated with magnetic field $\boxed{W = \frac{1}{2}LI_f^2}$

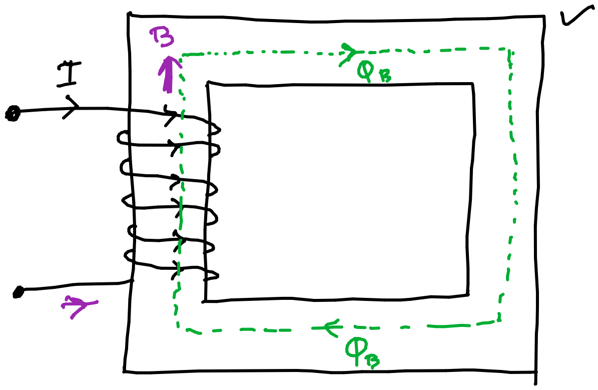
$$= \frac{1}{2}L\cdot\frac{\psi^2}{L^2}$$

Flux linkage $\psi = LI_f$

$$\Rightarrow I_f = \frac{\psi}{L}$$

$$\boxed{W = \frac{1}{2L}\psi^2}$$ ✓

$$H = \frac{NI}{l_c} \leftarrow \mathcal{F}$$



$$\mathcal{F} = H l_c$$

- Assumption :

  B is a linear function of H

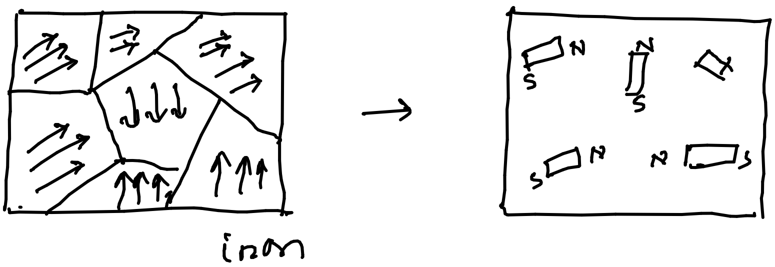
  $$B = \mu H$$

$$\varphi = \frac{\mathcal{F}}{\mathcal{R}_c} = \frac{NI}{\mathcal{R}_c}$$

- Since B & H are linear

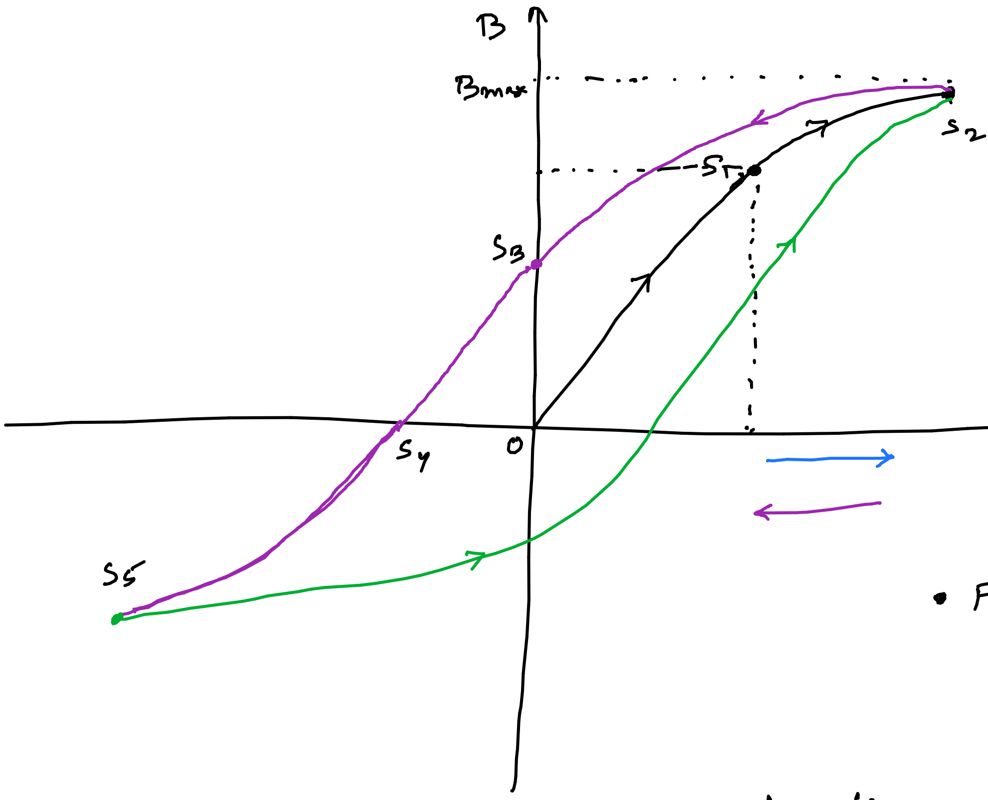
$\Downarrow$

φ & $\mathcal{F}$ are also linear.



H & B

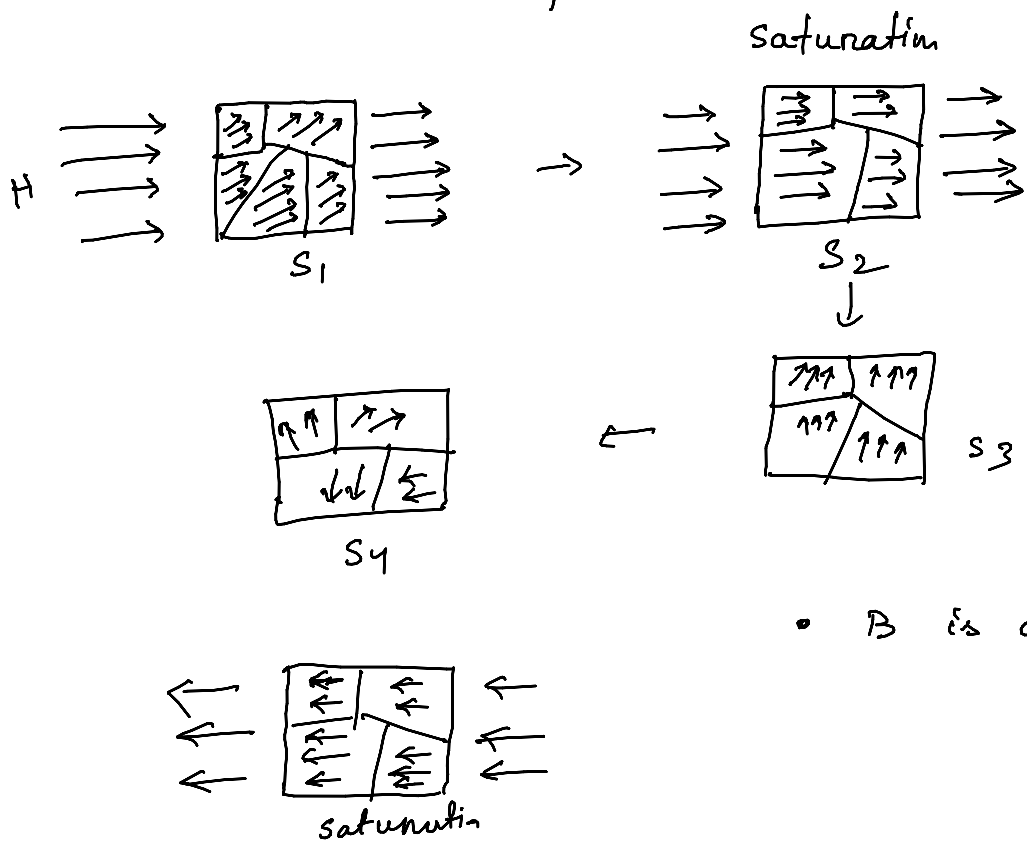
$$H = \frac{NI}{l_c}$$



B-H curve
or
Hysteresis loop

$H = \frac{NI}{l_c}$

- From O to S_1
  B is a linear funct^n of H
  $B = \mu_c H_c$



- B is a non-linear function of H.