Lecture # 18, 11/12/21

Today:

- Finish Ch5
- Finish example on DCM from lecture #17

$ax^2 + bx + c = 0$

$a = 1$

$b = D^2/k$

$c = -D^2/k$

get quadratic form

$$\left(\frac{V}{V_g}\right)^2 + \frac{D^2}{k}\left(\frac{V}{V_g}\right) - \frac{D^2}{k} = 0$$

apply quadratic eqn to get $M = \frac{V}{V_g}$

Solve for $\frac{V}{V_g}$ using quadratic eqn

$$\frac{V}{V_g} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

* to get form in book, use form below

$$= \frac{2c}{-b \pm \sqrt{b^2 - 4ac}}$$

$a = 1$

$b = D^2/k$

$c = -D^2/k$

* plug in values & simplify

$$= \frac{-2\,D^2/k}{-D^2/k \pm \sqrt{\left(\frac{D^2}{k}\right)^2 - 4(1)(-D^2/k)}}$$

$$= \frac{-2\,\cancel{D^2/k}}{-\cancel{D^2/k} \pm \frac{D^{\cancel{2}}}{k}\sqrt{1 + 4\,k/D^2}}$$

* discard $\ominus$ solution

$$\boxed{\begin{aligned} &= \frac{2}{1 + \sqrt{1 + 4K/D^2}} \\ &= \frac{V}{V_g} \end{aligned}}$$

Back $\frac{V}{V_g} = M$ for DCM

- Reading Assignment over next 1 week (by Nov 19th)

  ↳ $\overbrace{\underbrace{10.1}_{\text{magnetics basics}}, \underbrace{11.1 - 11.2}_{\text{inductor design}}}^{\text{3rd ed.}}$

- Review of magnetics fundamentals

electrical terminal variables

$v(t)$]* $\longleftrightarrow$ Faraday's Law $\longleftrightarrow$ $\underbrace{\overbrace{B(t)}^{\text{density}}, \overbrace{\Phi(t)}^{\text{total}}}_{****}$

$[Wb/m^2] = [T]$ magnetic intensity or magnetic flux density

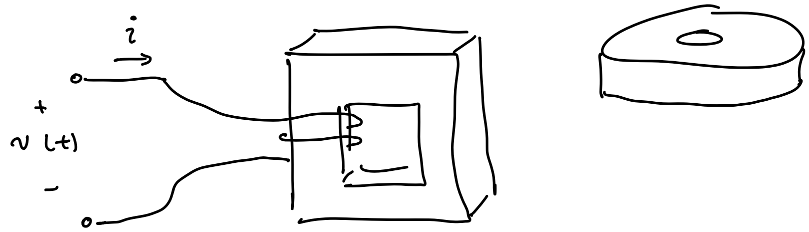
magnetic flux $[Wb] = [V \cdot s]$

$\updownarrow$ core material characteristics $B = \mu H$

$i(t)$]** $\longleftrightarrow$ Ampere's Law $\longleftrightarrow$ $\overbrace{\underbrace{H(t)}_{\text{density}}, \underbrace{\mathcal{F}(t)}_{\text{total}}}^{***}$

magnetic field strength $[A/m]$

(MMF) magneto motive force $[A]$

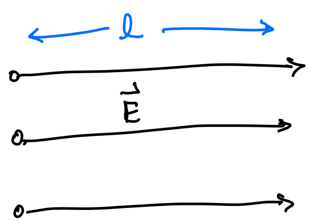


- strategy for analysis

↳ Develop "circuit-like" framework to analyze magnetics

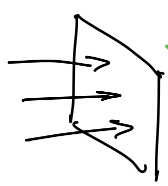
Electrical

*



$+ \quad v = E\ell \quad -$

- Total current I in [A]
- Current Density J in [A/m²] units



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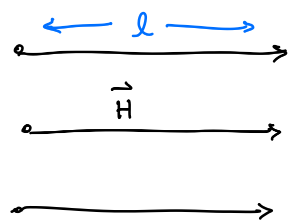
Magnetics



$+ \quad \tilde{F} = H\ell \quad -$

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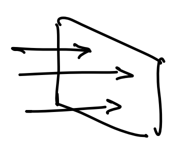
- Total flux Φ in [Wb]
- Flux density B in [Wb/m²]



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