Lecture 30

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1 Magnetic Circuits

We have a magnetomotive force $V_m = NI_0$, flux $\vec{J}$, reluctance $R = \frac{L}{\mu S}$, which are analogous to electric circuits. They follow two laws:

$$\sum_j V_{mj} = \sum_j N_j I_j = \sum_i R_i \Phi_i$$

$$\sum_i \Phi_i = 0$$

2 Inductance

$$L = \frac{\text{amount of magnetic flux produced by source}}{\text{strength of source}} = \frac{\Lambda}{I} = \frac{N\Phi}{I}$$

Example 2.1. Find the self inductance of a toroid.
By Ampère's Law,

$$\oint_C \vec{B} \cdot d\vec{l} = \mu_0 \mu_r I$$
$$2\pi r B = \mu_0 \mu_r N_1 I_1$$
$$\vec{B} = \frac{\mu_0 \mu_r N_1 I_1}{2\pi r} \hat{a}_z$$

To be continued...