Lecture 29

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March 27, 2023

1 Magnetic Flux

Definition 1.1. Magnetic Flux is defined as

$$\Phi = \iint_S \vec{B} \cdot d\vec{S}$$

with units of Wb.

Since

$$\vec{B} = \vec{\nabla} \times \vec{A}$$

we can transform the above to

$$\Phi = \oint_C \vec{A} \cdot d\vec{l} = \iint_S \vec{\nabla} \times \vec{A} \cdot d\vec{S}$$

Example 1.1. Find the magnetic flux within a toriod with a gap.
Now $\vec{B}$ field along the toroid is constant. Comparing μ, this gives $H_{\text{gap}} >> H_{\text{core}}$. From Ampère's Law,

$$\oint_C \vec{H} \cdot d\vec{l} = H_{\text{core}} L_{\text{core}} + H_{\text{gap}} L_{\text{gap}} = NI_0$$

Isolating for B_0,

$$B_0 = \frac{NI_0}{\frac{L_c}{\mu_0 \mu_r} + \frac{L_g}{\mu_0}}$$