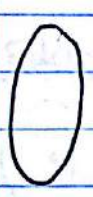
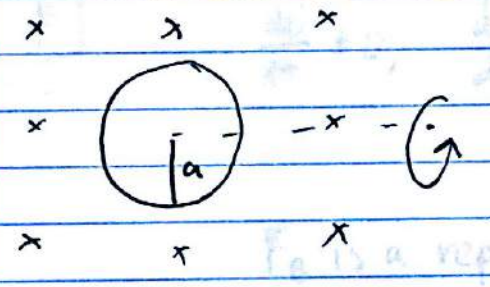
11/29/21



① Initially, bar magnet is far away
② Moving bar inside ring $\Rightarrow \frac{d\Phi}{dt}$.
③ Ring generates opposing field.
④ Force will lead to acceleration of magnet (opposes magnet)

Electric Generator

mechanical energy → electrical energy



$$\Phi_B = \vec{B}\cdot d\vec{A}$$

$\theta(t)$ - not concerned w/ time.

$$\Phi = \int \vec{B}\cdot d\vec{A} = B\cos\theta \int dA$$

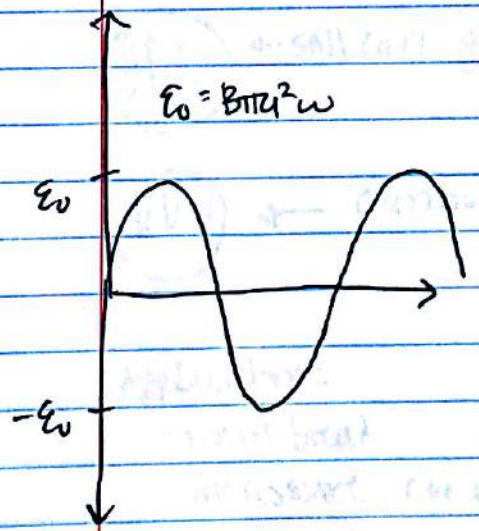
$$= B\cos\theta\, \pi a^2$$

$$\frac{d\Phi}{dt} = \frac{d}{dt}(B\cos\theta\, \pi a^2) \quad (\theta = \omega t)$$

$$= -B\sin(\omega t)\cdot \pi a^2 \omega$$

$$\boxed{\mathcal{E} = B\pi a^2 \omega \sin(\omega t)}$$

alternating EMF.



$$I(t) = \frac{B\pi a^2 \omega \sin(\omega t)}{R}$$

$$P = I^2 R = I_0^2 R \sin^2 \omega t, \quad P_0 = I_0 R$$

($\langle P \rangle = \frac{1}{2} P_0$).

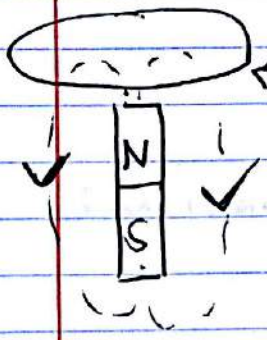
See AC Current Notes

Eddy Current (Circular)

conducting material

$\Rightarrow$ I induced when $\frac{d\Phi}{dt} \neq 0$

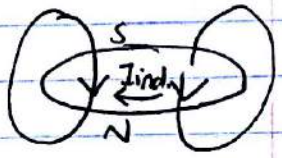
$\Rightarrow$ B induced



$\uparrow F_B$ when B changes

$\frac{dB}{dt} \neq 0$, $\frac{d\Phi}{dt} \neq 0$. Induced Current. $\Rightarrow B'$
(top of ring behaves as S
bottom of ring behaves as N)

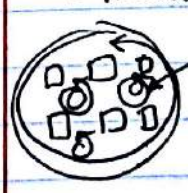
$\vec{F}_B$ is a repulsive force.

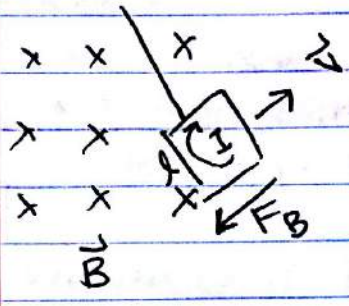


 ← still can generate an eddy current

 ← cannot generate an eddy current

Applications:
- train break
- measure crack in airplane wing (by measuring current)





$\frac{d\Phi}{dt} \neq 0$

$I_{induced}$ $\vec{B}$ same direction as $\vec{B}$

$\vec{F}_B = I\vec{l} \times \vec{B}$

→ opposes $\vec{v}$.

Flux is an old man that dislikes change.