Magnetic Induction: Application (9)

Consider a conducting rod of length L rotating with angular velocity ω in a plane perpendicular to a uniform magnetic field $\vec{B}$.

- Angular velocity of slice: ω
- Linear velocity of slice: $v = \omega r$
- EMF induced in slice: $d\mathcal{E} = Bv\,dr$
- Slices are connected in series.
- EMF induced in rod:

$$\mathcal{E} = \int_0^L Bv\,dr = B\omega \int_0^L r\,dr$$

$$\Rightarrow\ \mathcal{E} = \frac{1}{2}B\omega L^2 = \frac{1}{2}Bv_0L, \quad v_0 = \omega L$$