Alternating Current Generator

Coil of N turns and cross-sectional area A rotating with angular frequency ω in uniform magnetic field $\vec{B}$.

- Angle between area vector and magnetic field vector: $\theta = \omega t$.
- Flux through coil: $\Phi_B = NBA\cos(\omega t)$.
- Induced EMF: $\mathcal{E} = -\dfrac{d\Phi_B}{dt} = \mathcal{E}_{max}\sin(\omega t)$ with amplitude $\mathcal{E}_{max} = NBA\omega$.
- U.S. household outlet values:
  - $\mathcal{E}_{max} = 120\text{V}\sqrt{2} \simeq 170\text{V}$
  - $f = 60\text{Hz}, \quad \omega = 2\pi f \simeq 377\text{rad/s}.$