Answer on Question #45705 – Physics – Electromagnetism

Question: a rectangular coil of dimensions $20\ \text{cm}$ by $15\ \text{cm}$ lies with its plane parallel to a magnetic field of $0{,}5\ \text{W} \cdot \text{m}^2$.The coil, carrying a current of $10\ \text{A}$ experiences a torque of $4.5\ \text{N} \cdot \text{m}$ in the field. How many loops has the coil?

Solution: a rectangular coil, which has area S, number of loops N and carries current I, possess a magnetic moment

$$\mu = I \cdot N \cdot S.$$

Since the torque experienced by the coil is determined by equation

$$\boldsymbol{T} = \boldsymbol{\mu} \times \boldsymbol{B},$$

number of loops of the coil can be obtained from the equality of the last two equations

$$T = INSB \sin \alpha.$$

The coil is parallel to the magnetic field, thus $\alpha = \frac{\pi}{2}$ and

$$N = \frac{T}{I \cdot S \cdot B} = \frac{4{,}5}{0{,}2 \cdot 0{,}15 \cdot 10 \cdot 0{,}5} = 30.$$

Answer:

$$N = \frac{T}{I \cdot S \cdot B} = 30.$$