Thursday Reading Assessment: Unit 3, Magnetic Forces and Fields

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1 Memory Bank

- $\vec{F} = q\vec{v} \times \vec{B}$ ... The Lorentz force, one version.
- $\vec{F} = i\vec{L} \times \vec{B}$ ... The Lorentz force, another version.
- $\vec{\tau} = \vec{r} \times \vec{F}$ ... Definition of torque.
- $\vec{\tau} = \vec{\mu} \times \vec{B}$ ... Torque on a current carrying loop in a uniform B-field.
- $\vec{\mu} = Ni\vec{A}$ ... Definition of the magnetic moment.

2 Torque, revisited

1. Suppose we apply a force $\vec{F} = 10\hat{j}$ N (upward) on the end of a 10 cm wrench it as *loosens* a bolt at the origin. The bolt is to the left of the wrench. What is the magnitude *and direction* of the torque?

3 The Power Generator

1. Consider Fig. 1, in which a DC power generator is depicted inside a 0.05 T B-field. Suppose the area of the loop is 10^{-2} m^2, the voltage in the circuit is 24 V, and the circuit resistance is 50 Ω. Also assume that there is just one loop of wire in the rotor. What is the *maximum torque* the system could achieve?

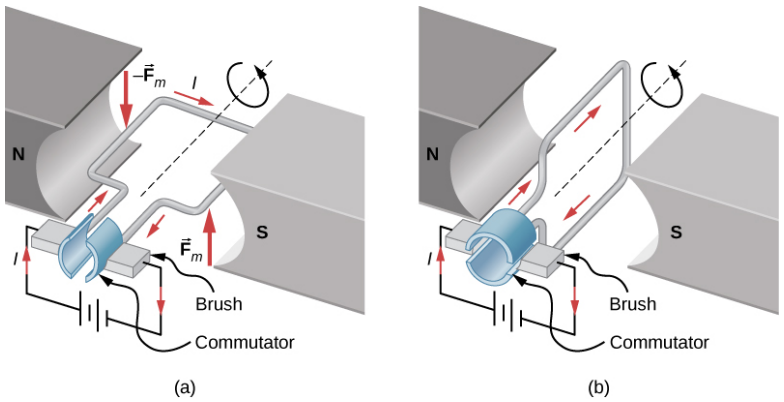

Figure 1: An illustration of how a power generator works. This version uses DC current and a commutator.

2. What would the maximum torque be if there were $N = 100$ turns of wire?