EEC 130A: Homework 8

Due: 3:30 pm, Mar. 5th, 2013

1. (FAE P5.2) When a particle with charge q and mass m is introduced into a medium with a uniform field $\mathbf{B}$ such that the initial velocity of the particle $\mathbf{u}$ is perpendicular to $\mathbf{B}$ (Fig. 1), the magnetic force exerted on the particle causes it to move in a circle of radius a. By equating $\mathbf{F_m}$ to the centripetal force on the particle, determine a in terms of q, m, u, and $\mathbf{B}$.

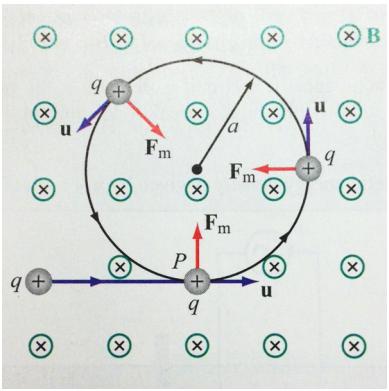

Figure 1: (FAE Fig. P5.2) Particle of charge q projected with velocity u into a medium with a uniform field $\mathbf{B}$ perpendicular to $\mathbf{u}$ (Problem 5).

2. (FAE P5.10) An infinitely long, thin conducting sheet defined over the space $0 \leq x \leq w$ and $-\infty \leq y \leq \infty$ is carrying a current with a uniform surface current density $\mathbf{J}_s = \hat{\mathbf{y}}5$ (A/m). Obtain an expression for the magnetic field at point $P = (0, 0, z)$ in Cartesian coordinates.

3. (FAE P5.14) Two parallel, circular loops carrying a current of 40 A each are arranged as shown in Fig. 2. The first loop is situated in the x-y plane with its center at the origin, and the second loop's center is at $z = 2$ m. If the two loops have the same radius $a = 3$ m, determine the magnetic field at:

(a) $z = 0$

(b) $z = 1$ m

(c) $z = 2$ m

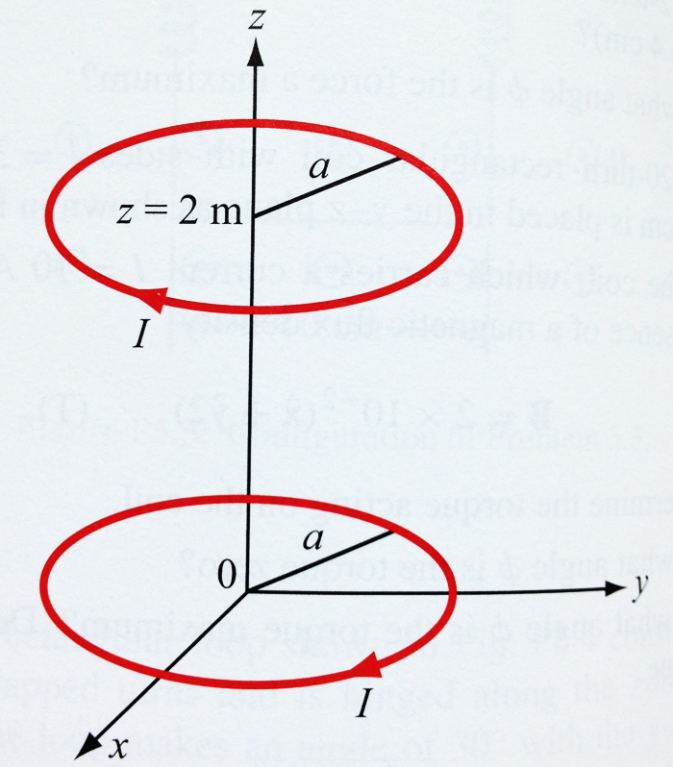

Figure 2: (FAE Fig. P5.14) Parallel circular loops of Problem 3.