Problem Set 10

Physics 110A, UC Berkeley, Spring 2021

Due Monday, 4/26, at 11:59PM

Problem 1

An infinitely large sheet, parallel with the xy-plane, lies at $z = +d/2$ and has a uniform current density $\boldsymbol{K} = -kt\,\hat{x}$ flowing on it. Another infinitely large sheet, again parallel with the xy-plane, lies at $z = -d/2$ and has a uniform current density $\boldsymbol{K} = +kt\,\hat{x}$. In below we consider the fields in the quasi-static limit.

(a) Find the magnetic field due the electric currents everywhere in the space.

(b) Find the electric field due to the time-varying magnetic field everywhere in the space.

Problem 2

A long cylinder of radius R with charge density $\rho(s) = a/s$ rotates around its axis, the z-axis, with angular velocity ω. (a is a constant.) The permeability of the cylinder is μ. A circular wire of radius L on the xy-plane, surrounding the cylinder ($L > R$), has a constant line charge density λ. The circle is initially at rest, and then the angular velocity of the cylinder is dropped from ω to 0. Find the angular momentum of the circle after the cylinder stops rotating, assuming that the circle rotates without friction.

Problem 3

Alfven's theorem: See Problem 7.63 of Griffiths.

Below are selected optional problems from Griffiths. We do not collect your work, but you are encouraged to do as many practice problems as you can.

- Problem 7.6
- Problem 7.7
- Problem 7.8
- Problem 7.9
- Problem 7.11
- Problem 7.13
- Problem 7.16
- Problem 7.17
- Problem 7.22
- Problem 7.29
- Problem 7.30
- Problem 7.32