Problem Set 10

Physics 110A, UC Berkeley, Spring 2021

Due Monday, 4/19, at 11:59PM

Problem 1

An infinite slab of thickness d with a uniform magnetization $\boldsymbol{M} = M_x\,\hat{\boldsymbol{x}} + M_y\,\hat{\boldsymbol{y}} + M_z\,\hat{\boldsymbol{z}}$ (M_x, M_y, M_z are constants) extends along the xy-plane. Find the magnetic field $\boldsymbol{B}$ for a point at a distance L from the infinite slab.

Problem 2

A long cylinder of radius R carries a magnetization parallel to the axis $\boldsymbol{M} = ks^2\,\hat{\boldsymbol{z}}$, where k is a constant and s is the distance from the axis.

(a) Find the magnetic field inside and outside the cylinder.

(b) Find $\boldsymbol{H}$ inside and outside the cylinder.

(c) Check that the Ampére's law (6.20) in Griffiths is satisfied.

Problem 3

A long cylinder of radius R carries a current with current density $\boldsymbol{J}(s) = J(s)\,\hat{\boldsymbol{z}}$ along its axis. The cylinder is a linear material with permeability μ, and the magnetic field is found to be $\boldsymbol{B} = ks^2\,\hat{\boldsymbol{\phi}}$. Find $J(s)$.

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 6.4
- Problem 6.7
- Problem 6.8
- Problem 6.9
- Problem 6.13
- Problem 6.15
- Problem 6.16
- Problem 6.18
- Problem 6.21
- Problem 6.23
- Problem 6.24
- Problem 6.26
- Problem 6.28