EM Scattering

Homework assignment 2

Problem 1:

A plane wave traveling in the x direction in vacuum is scattered by a perfectly conducting, infinite cylinder with the radius of 1cm whose axis coincides with the z-axis. The frequency of the incident wave is 30GHz and its electric field is polarized along the z-axis. The amplitude of the incident electric field is E_0.

- Calculate the electric and magnetic fields in the far zone and plot their amplitude as function of angle
- Calculate the current density on the surface of the cylinder and plot it as function of angle

Problem 2:

The problem of scattering from perfectly conducting cylinders was treated in the class by using the $\boldsymbol{M}$ and $\boldsymbol{N}$ functions. The same method may be exploited to solve the scattering problem from a dielectric cylinder. Consider a dielectric cylinder with the radius a and relative dielectric constant ε_d. The axis of the cylinder coincides with the z-axis. The incident wave travels along $\boldsymbol{k}_i$. For simplicity assume normal incidence, i.e., $k_{i,z} = 0$.

- In the region inside the cylinder write the electric field vector as a series in appropriate $\boldsymbol{M}$ and $\boldsymbol{N}$ functions.
- Outside the cylinder write the field as the incident plus the scattered field and expand each in series.
- Match the solutions at the surface of the cylinder and find the scattered field.