Problem set 10

Problem 1

In cylindrical electromagnetic cavities the transverse electric modes are noted by TE_{mnp}, where p is the index for the component in the z-direction (the axis of the cylinder), m is associated with the angle ϕ, and n with the radial coordinate r. We consider a cylindrical cavity with height d and radius a.

Use the general expressions for the TE_{mnp} modes derived in Problem set 10 2014. When the cylindrical waveguide is closed at $z = 0$ and d we have to add $H_r \sim J'(\chi'_{01} r/a) \cos(\pi z/d)$ to the TE_{011} mode.

(a) Show how the TE_{011} mode fulfills the boundary conditions and sketch the field lines for its components.

(b) Find the asymptotic forms of the field components as $r << a$ in the center of the cylinder.

(c) Find a vector potential $\mathbf{A}$ that can deliver the asymptotic fields in the center of the cylindrical cavity.

The problem is due Monday March 24 2025 at 20:00