

- (b) Determine the minimum thickness d in terms of free space wavelength such that the undesirable component of the incident field is attenuated by $1/e$.

Wave plate:

- (c) Assign x, y, z to u, v, w (not necessarily in that order) so that, for a given linearly polarized incident electric field, the transmitted field is circularly polarized. Specify the axes so that there is no power absorption. Give an expression for an incident electric field such that, given the correct thickness d , the transmitted electric field is circularly polarized. What is the minimum correct d ? Sketch the rotation of E field on the right surface (i. e. $w = d$) of the slab with this minimum d .

Problem P2.3

In a ferrite, the magnetic moment \overline{M} roughly obeys the relationship $d\overline{M}/dt = g\mu_0\overline{M} \times \overline{H}$, where g is the gyromagnetic ratio. When a \hat{z} -directed dc magnetic field \overline{H}_0 (zeroth order) is present, the total fields take the form $\overline{H} = \hat{z}H_0 + \overline{H}_1$, $\overline{M} = \hat{z}M_0 + \overline{M}_1$, and $\overline{B} = \mu_0(\overline{H} + \overline{M})$.

- (a) For the cross product $\hat{z} \times \overline{H}_1$, convert it to be $\overline{z} \cdot \overline{H}_1$. What is \overline{z} ?
(b) To the first order approximation, $\overline{M}_1 \times \overline{H}_1$ is negligible. Show that the permeability $\overline{\mu}$ which satisfies $\overline{B}_1 = \overline{\mu} \cdot \overline{H}_1$ has the form of

$$\overline{\mu} = \begin{bmatrix} \mu & i\mu_g & 0 \\ -i\mu_g & \mu & 0 \\ 0 & 0 & \mu_z \end{bmatrix}$$

- (c) Find dispersion relations for the first-order fields in kDB system.
(d) Show that Faraday rotation exists in the ferrite.