HW 6

Probelm 1

$$对于 ordinary\, wave, \theta_1 = \theta_2$$
$$对于 extraordinary\, wave, \theta_2 > \theta_1$$

Problem 2

(a)

$$由于\sigma_z = 0.2\epsilon_0 > 0且足够厚$$
$$把z变换到u或v都能满足条件$$

(b)

$$等价于求 d_p$$
$$K_I = w\sqrt{u\epsilon}[\frac{1}{2}(\sqrt{1+\frac{\sigma^2}{\epsilon^2 w^2}}-1)]^{0.5}$$
$$d_p = \frac{1}{K_I} = 3.18\lambda$$

(c)

$$z->w, x->u, y->v$$
$$E_{inc} = \frac{E_o}{\sqrt{2}}(x-y)cos(k_0 z - wt)$$
$$z = d时，由于是 circularly\, polarized$$
$$(2\sqrt{3}-1)k_0 d = \frac{\pi}{2}$$
$$d = \frac{\lambda}{4(2\sqrt{3}-1)}; 此时是右旋的$$

Problem 3

(a)

$$\overline{\overline{z}} = [\begin{matrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{matrix}]$$

(b)

$$\frac{dM}{dt} = gu_0 M \times H = gu_0[(\vec{z}M_0 + M_1) \times (\vec{z}H_0 + H_1)]$$

$$\text{由于} M_1 \times H_1 \text{可忽略}$$

$$\text{上式等于} gu_0(M_0\vec{z} \times H_1 - H_0\vec{z} \times M_1)$$

$$= gu_0(M_0\overline{\overline{z}} \cdot H_1 - H_0\overline{\overline{z}} \cdot M_1)$$

$$B = u_0(H + M)$$

$$B_1 = u_0(H_1 + M_1) = \overline{\overline{u}} \cdot H_1$$

$$\text{可以得到} \overline{\overline{u}} = \begin{bmatrix} u & iu_g & 0 \\ -iu_g & u & 0 \\ 0 & 0 & u_z \end{bmatrix}$$

(c)

$$\overline{\overline{v}} = \begin{bmatrix} v & iv_g & 0 \\ -iv_g & u & 0 \\ 0 & 0 & v_z \end{bmatrix}$$

$$=> \begin{bmatrix} u^2 - kv & -ikv_g cos\theta \\ ikv_g cos\theta & u^2 - k(vcos^2\theta + v_z sin^2\theta) \end{bmatrix} \cdot \begin{bmatrix} B_1 \\ B_2 \end{bmatrix} = 0$$

$$\frac{D_2}{D_1} = -\frac{B_1}{B_2} = \frac{(v - nu_0)sin^2\theta_0 \pm \sqrt{(v - v_0)^2 sin^4\theta + 4v_g^2 cos^2\theta^2}}{2iv_g cos\theta}$$

(d)

$$\text{定义} cos2\phi = \frac{2v_g cos\theta}{(v - v_z)sin^2\theta}$$

$$\frac{D_2}{D_1} = itan\phi \text{或} icot\phi, \text{是椭圆极化波}$$

$$=> Faraday\ \ rotation\ \ exists$$