HW 5

Problem 1

$$由于\overline{k} = \overline{\epsilon}^{-1}$$

$$k = \frac{\epsilon}{\epsilon^2 - \epsilon_g^2}$$

$$k_g = \frac{-\epsilon_g}{\epsilon^2 - \epsilon_g^2}$$

$$k_z = \frac{1}{\epsilon_z}$$

$$k = \frac{1}{\epsilon_0} \cdot \frac{1 - \frac{w_p^2}{(w^2 - w_c^2)}}{(1 - \frac{w_p^2}{(w^2 - w_c^2)})^2 - \frac{w_p^4 w_c^2}{w^2 (w^2 - w_c^2)^2}}$$

$$= \frac{1}{\epsilon_0} \cdot \frac{(w^2 - w_c^2)(w^2 - w_c^2 - w_p^2)}{(w^2 - w_c^2 - w_p^2)^2 - \frac{w_p^4 w_c^2}{w^2}}$$

$$k_g = \frac{1}{\epsilon_0} \cdot \frac{\frac{-w_p^2 w_c}{w(w^2 - w_c^2)}}{(1 - \frac{w_p^2}{(w^2 - w_c^2)})^2 - \frac{w_p^4 w_c^2}{w^2 (w^2 - w_c^2)^2}}$$

$$= \frac{1}{\epsilon_0} \cdot \frac{\frac{-w_p^2 w_c}{w} \cdot (w^2 - w_c^2)}{(w^2 - w_c^2 - w_p^2)^2 - \frac{w_p^4 w_c^2}{w^2}}$$

$$k_z = \frac{1}{\epsilon_z} = \frac{1}{\epsilon_0 [1 - \frac{w_p^2}{w^2}]} = \frac{w^2}{\epsilon (w^2 - w_p^2)}$$