



24.8200 Engineering Electromagnetics

ASSIGNMENT 4

Due Date: Tuesday October 24, 2006

Instructor: J. LoVetri

Note: You can use any references you like, but make sure that your solutions are complete.

- 1) Derive the Kramers-Kronig relations for a genral medium having admittivity $\hat{y} = j\omega\hat{\epsilon}(\omega) + \sigma$ and impedivity $\hat{z} = j\omega\hat{\mu}(\omega)$.

(See Jackson Chapter 7, where the Kramers-Kronig relations for a medium having admittivity $\hat{y} = j\omega\hat{\epsilon}(\omega)$ and impedivity $\hat{z} = j\omega\hat{\mu}(\omega)$ are derived as:

$$\text{Re}\{\hat{\epsilon}(\omega)\} = \epsilon_0 + \frac{2}{\pi} \int_0^{\infty} \frac{\omega' \text{Im}\{\hat{\epsilon}(\omega')\}}{\omega'^2 - \omega^2} d\omega'$$

$$\text{Im}\{\hat{\epsilon}(\omega)\} = -\frac{2\omega}{\pi} \int_0^{\infty} \frac{\text{Re}\{\hat{\epsilon}(\omega') - \epsilon_0\}}{\omega'^2 - \omega^2} d\omega'$$

where the notation \int means that the principal part of the intergral is taken.)