EE6311 Fall 2009 Homework #1

2.2 A transmission line has the following per unit length parameters: $L = 0.2\ \mu$H/m, $C = 300$ pF/m, $R = 5\ \Omega$/m, and $G = 0.01$ S/m. Calculate the propagation constant and characteristic impedance of this line at 500 MHz. Recalculate these quantities in the absence of loss ($R = G = 0$).

2.12 A radio transmitter is connected to an antenna having an impedance $80 + j40\ \Omega$ with a $50\ \Omega$ coaxial cable. If the $50\ \Omega$ transmitter can deliver 30 W when connected to a $50\ \Omega$ load, how much power is delivered to the antenna?

2.15 The transmission line circuit shown below has $V_g = 15$ V rms, $Z_g = 75\ \Omega$, $Z_0 = 75\ \Omega$, $Z_L = 60 + j40\ \Omega$, and $\ell = 0.7\lambda$. Compute the power delivered to the load using three different techniques:

(a) find Γ and compute

$$P_L = \left(\frac{V_g}{2}\right)^2 \frac{1}{Z_0}\left(1 - |\Gamma|^2\right);$$

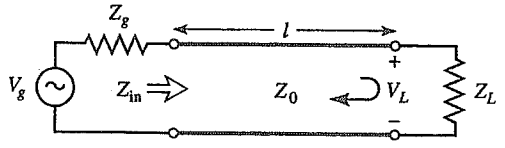
(b) find Z_{in} and compute

$$P_L = \left|\frac{V_g}{Z_g + Z_{\text{in}}}\right|^2 \text{Re}\,(Z_{\text{in}});\ \text{and}$$

(c) find V_L and compute

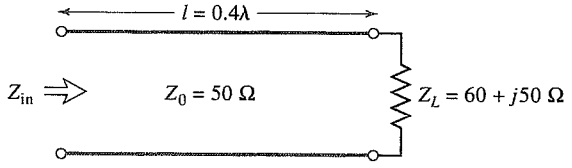
$$P_L = \left|\frac{V_L}{Z_L}\right|^2 \text{Re}(Z_L).$$

Discuss the rationale for each of these methods. Which of these methods can be used if the line is not lossless?



2.19 Use the Smith chart to find the following quantities for the transmission line circuit below:

(a) The SWR on the line.
(b) The reflection coefficient at the load.
(c) The load admittance.
(d) The input impedance of the line.
(e) The distance from the load to the first voltage minimum.
(f) The distance from the load to the first voltage maximum.



2.22 Use the Smith chart to find the shortest lengths of a short-circuited $75\ \Omega$ line to give the following input impedance:

(a) $Z_{\text{in}} = 0$.
(b) $Z_{\text{in}} = \infty$.
(c) $Z_{\text{in}} = j75\ \Omega$.
(d) $Z_{\text{in}} = -j50\ \Omega$.
(e) $Z_{\text{in}} = j10\ \Omega$.

2.23 Repeat Problem 2.22 for an open-circuited length of $75\ \Omega$ line.