ELECTROMAGNETICS THEORY
BEKP3553
1-2006/2007

Tutorial 7

Transmission Line

1) Calculate the line parameter R', L', G' and C' for a coaxial line with the inner conductor diameter of 0.5cm and an outer conductor diameter of 1cm, filled with insulating material where $\mu = \mu_0, \varepsilon_r = 2.25$ and $\sigma = 10^{-3} S/m$. The conductors are made of copper with $\mu_c = \mu_0$ and $\sigma_c = 5.8 \times 10^7 S/m$. The operating frequency is 1GHz.

2) Find α and Z_0 of a distortionless line when whose R'= 4 ohm/m and G' = 4x 10^{-4} S/m.

3) A 50-Ω lossless transmission line is terminated in a load with impedance $Z_L = (30 - j60)\Omega$. The wavelength is 5cm. Find:

   (i) The reflection coefficient at the load.

   (ii) The standing-wave ratio on the line.

   (iii) The position of the voltage maximum nearest the load.

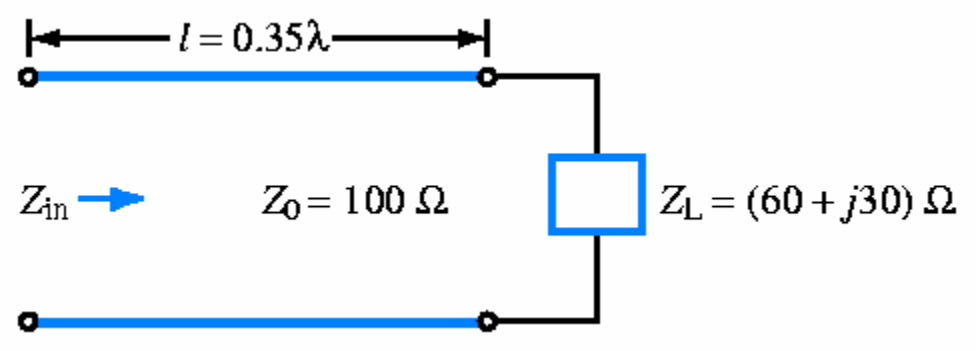
   (iv) The position of the current maximum nearest the load.

4) A lossless transmission line of electric length $l = 0.35\lambda$ is terminated in a load impedance as shown in Figure 5. Find:

   (i) Γ

   (ii) S

   (iii) Z_{in}



5) A 6-m section of 150 Ω lossless lines is driven by a source with

$$v_g(t) = 5 \cos (8\pi \times 10^7\, t - 30^o) \quad \text{(V)}$$

and Z_g = 150 Ω. If the line, which has a relative permittivity ε_r = 2.25, is terminated in a load $Z_L = (150 - j50)\ \Omega$, find the following:

(a) Wavelength (λ) on the line.

(b) The reflection coefficient at the load.

(c) The input impedance.

(d) The input voltage $\tilde{V}_i$.

(e) The time-domain input voltage $v_i(t)$.

6) A 50 Ω lossless lines of length $l = 0.375\,\lambda$ connects a 200 MHz generator with $\tilde{V}_g = 150V$ and Z_g = 50 Ω to a load Z_L. Determine the time-domain current through the load for:

a) $Z_L = (50 - j50)\ \Omega$

b) $Z_L = 50\ \Omega$

c) Z_L = 0 (short circuit)