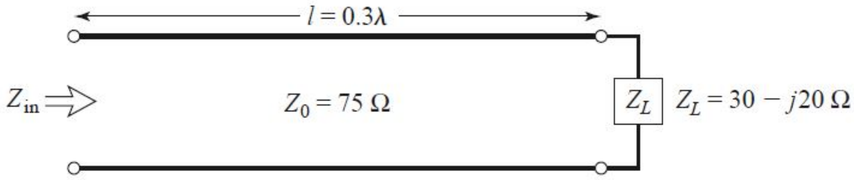
Pozar Problems: 2.2, 2.3, 2.4, 2.8, 2.10, 2.11, 2.12, 2.16, 2.18, 2.20

2.2 A transmission line has the following per-unit-length parameters: $L = 0.5$ μH/m, $C = 200$ pF/m, $R = 4.0$ Ω/m, and $G = 0.02$ S/m. Calculate the propagation constant and characteristic impedance of this line at 800 MHz. If the line is 30 cm long, what is the attenuation in dB Recalculate these quantities in the absence of loss ($R = G = 0$).

2.3 RG-402U semirigid coaxial cable has an inner conductor diameter of 0.91 mm and a dielectric diameter (equal to the inner diameter of the outer conductor) of 3.02 mm. Both conductors are copper and the dielectric material is Teflon. Compute the R, L, G and C parameters of this line at 1 GHz, and use these results to find the characteristic impedance and attenuation of the line at 1 GHz. Compare your results to the manufacturer's specifications of 50 Ω and 0.42 dB/m, and discuss reasnos for the difference.

2.4 Compute and plot the attenuation of the coaxial line of Problem 2.3, in dB/m, over a frequency range of 1 MHz to 100 GHz. Use log-log graph paper.

2.8 A lossless transmission line of electrical length $l = 0.3\lambda$ is terminated weith a complex load impedance as shown in the accompanying figure. Find the reflection coefficient at the load, the SWR on the line, the reflection coefficient at the input of the line, and the input impedance to the line.

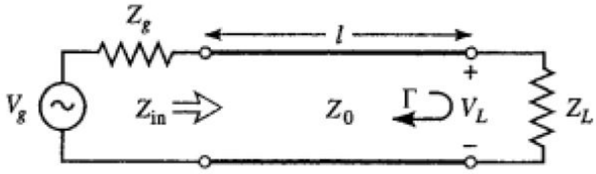


2.10 A terminated transmission with $Z_0 = 60$ Ωhas a reflection coefficient at the load of $\Gamma = 0.4\angle 60^o$. (a) What is the load impedance? (b) What is the reflection coefficient 0.3λaway from the load? (c) What is the input impedance at this point?

2.11 A 100Ω transmission line has an effective dielectric constant of 1.65. Find the shortest open-circuited length of this line that appears at its input as a capacitor of 5 pF at 2.5 GHz. Repeat for an open inductance of 5 nH.

2.12 A lossless transmission line is terminated with a 100Ω load. If the SWR on the line is 1.5, find the two possible values for the characteristic impedance of the line.

2.16 The transmission line circuit in the accompanying figure has $V_g = 15$ V rms, $Z_g = 75$ Ω, $Z_0 = 75$ Ω, $Z_L = 60 - j40$ Ω, and $l = 0.7\lambda$. 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

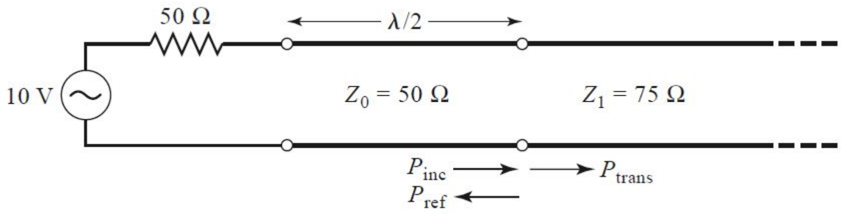
$$P_L = \left|\frac{V_g}{Z_g + Z_{in}}\right|^2 \mathrm{Re}\left\{Z_{in}\right\};$$

(c) find V_L and compute

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

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

2.18 Consider the transmission line circuit shown in the accompanying figure. Compute the incident power, the reflected power, and the power transmitted into the infinite 75 Ω line. Show that power conservation is satisfied.



2.20 Use the Smith chart to find the following quantities for the transmission line circuit shown in the accompanying figure:
(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.