Universidad Nacional de Colombia
Engineering Faculty
Electric and Electronics Engineering Department

Javier Leonardo Araque Quijano
jlaraqueq@unal.edu.co
Building 453 - office 204
Phone ext.: 14083

Transmission Lines and Antennas (2016503)
Groups 1-2, 2012-3
Exercises on Transmission Lines

1 Pozar, 2.9

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 Pozar, 2.10

Let Z_{sc} be the input impedance of a length of an arbitrary transmission line when the other end is short-circuited, and let it be Z_{oc} when it is open-circuited. Derive an expression for the characteristic impedance of the cable in terms of these.

3 Pozar, 2.16

For a purely reactive load impedance of the form $Z_L = jX$, show that the reflection coefficient magnitude Γ is always unity. Assume the characteristic impedance Z_0 is real.

4 Pozar, 2.17

Consider the transmission line circuit shown in Fig. 1. Compute the incident power, the reflected power, and the power transmitted into the infinite 75Ω line. Show that power conservation is satisfied.

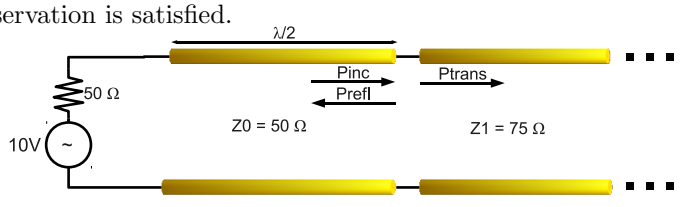

Figure 1: Circuit for power calculations.

5 Variation of Pozar, 2.22

Using the formulas for the input impedance of a terminated transmission line, find the shortest lengths of a short-circuited 75Ω line to give the following input impedance:

1. $Z_{in} = 0$
2. $Z_{in} = \infty$
3. $Z_{in} = j75\Omega$
4. $Z_{in} = -j50\Omega$
5. $Z_{in} = j10\Omega$

6 (Pozar, problem 2.26)

For the $\lambda/4$ transformer in Fig. 2 derive expressions for V^+ and V^- in terms of the incident voltage amplitude V^i.

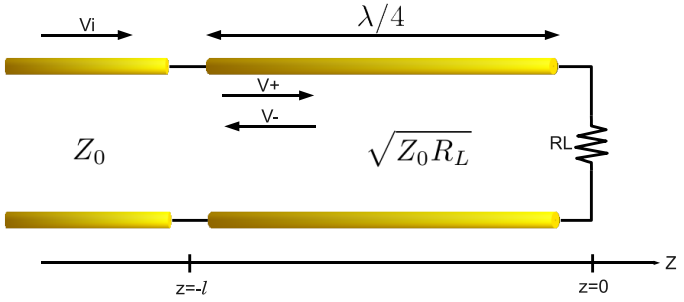

Figure 2: Quarter-wavelength transformer.

7 (Pozar, problem 2.30)

A 50Ω transmission line is matched to a 10 V source and feeds a load $Z_L = 100\Omega$. If the line is 2.3λ long and has an attenuation constant $\alpha = 0.5\text{dB}/\lambda$, find the powers that are delivered by the source, lost in the line, and delivered to the load.

References

[1] D. M. Pozar, *Microwave Engineering.* John Wiley & sons, 1998.

[2] R. E. Collin, *Foundations of Microwave Engineering.* IEEE press, 2001.