EEC 130A: Homework 4

Due: 3:30 pm, Feb. 7th, 2013

1. (4 points) (FAE P2.68) **Single-stub Matching** A 50-Ω lossless line is to be matched to an antenna with $Z_L = (75 - j20)\ \Omega$ using a shorted stub. Use the Smith chart to determine the stub length and distance between the antenna and stub.

2. (4 points) (FAE P2.74) A 25-Ω antenna is connected to a 75-Ω lossless transmission line. Reflections back toward the generator can be eliminated by placing a shunt **reactance** Z at a distance l from the load (Fig. 1). Determine the values of Z and l.

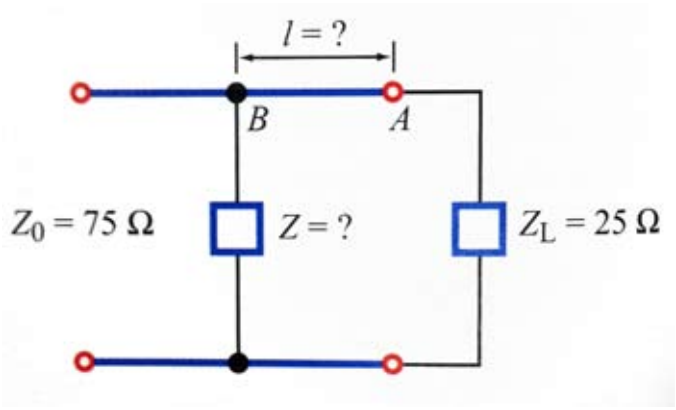

Figure 1: Circuit for Problem 2.

3. (4 points) (FAE P2.78) In response to a step voltage, the voltage waveform shown in Fig. 2 was observed at the sending end of a shorted line with $Z_0 = 50\ \Omega$ and $\epsilon_r = 4$. Determine V_g, R_g, and the line length.

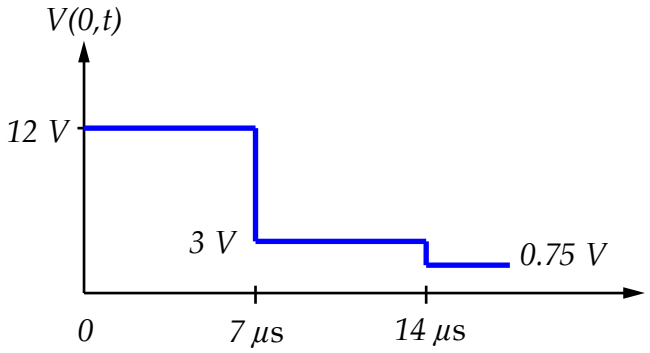

Figure 2: Voltage waveform of Problem 3.

4. (4 points) (FAE P2.80) A generator circuit with $V_g = 200$ V and $R_g = 25\ \Omega$ was used to excite a 75-Ω lossless line with a rectangular pulse of duration $\tau = 0.4\ \mu$s. The line is 200 m long, its $u_p = 2 \times 10^8$ m/s, and it is terminated in a load $R_L = 125\ \Omega$.

(a) Synthesize the voltage pulse exciting the line as the sum of two step functions, $V_{g1}(t)$ and $V_{g2}(t)$.

(b) For each voltage step function, generate a bounce diagram for the voltage on line.

(c) Use the bounce diagrams to plot the total voltage at the sending end of the line.

5. (4 points) (FAE P2.81) For the circuit of Problem 2 (FAE P2.80), generate a bounce diagram for the current and plot its time history at the middle of the line.