EEC 130A: Homework 5

Due: 3:30 pm, Tuesday, Feb. 10th, 2015

1. (FAE P2.78) In response to a step voltage, the voltage waveform shown in Fig. 1 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.

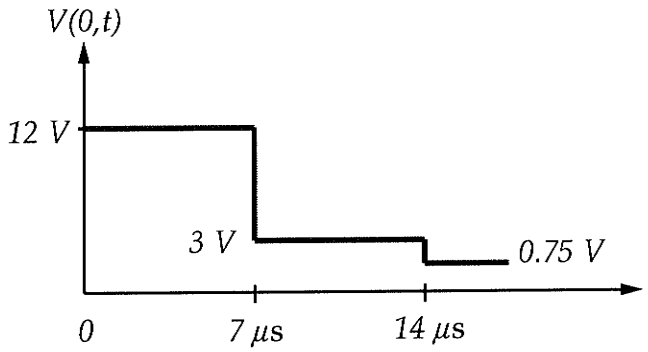

Figure 1: Voltage waveform of Problem 3.

2. (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.

3. (FAE P4.5) Find the total charge on a circular disk defined by $r \leq a$ and $z = 0$, if:

(a) $\rho_s = \rho_{s0} \cos\phi$ (C/m^2)

(b) $\rho_s = \rho_{s0} e^{-r} \sin^2\phi$ (C/m^2)

where ρ_{s0} is a constant.

4. (FAE P4.16) A line of charge with uniform density ρ_l extends between $z = -L/2$ and $z = L/2$ along the z-axis. Apply Coulomb's law to obtain an expression for the electric field at any point $P = (r, \phi, 0)$ on the x-y plane.

5. (FAE P4.18) Multiple charges at different locations are said to be in equilibrium if the force acting on any one of them is identical in magnitude and direction to the force acting on any of the others. Suppose we have two negative charges, one located at the origin and carrying charge of $-9e$, and the other located on the positive x-axis at a distance d from the first one and carrying charge $-36e$. Determine the location, polarity and magnitude of a third charge whose placement would bring the entire system into equilibrium.