Homework 2
EE 381 Electric & Magnetic Fields (Fall 2024)
Thursday, September 12, 2024

1) 11.30 Also, calculate the load Γ_L & input Γ_{in} reflection coefficients.
2) 11.33 Note that generator voltage is in RMS. Before parts b) - d), find V_0^+, V_0^-, & $V_S(z)$ in RMS. **Hint:** What the text calls V is $V_S(z)$.
3) 11.37 Solve analytically. Also, find the load reflection coefficient Γ_L, reflection coefficient $\Gamma_{\lambda/4}$ a $\lambda/4$ from load, and standing wave ratio.
4) A lossless transmission line (Z_0 = 50 Ω, $u = 2.3\times10^8$ m/s) of some length l is terminated with an unknown load Z_L. Using a vector network analyzer (VNA), an input impedance $Z_{in} = 75 - j30\ \Omega$ is measured. The transmission line is connected to a generator operating at 980 MHz with a voltage $v_g(t) = 25\cos(\omega t)$ V and impedance $Z_g = 60\ \Omega$. Draw the transmission line circuit. Then, determine (a) the phase constant β & wavelength λ for the transmission line, (b) the phasor current I_0 & voltage V_0 at the input, (c) the input reflection coefficient Γ_{in}, (d) the phasor forward V_0^+ & backward V_0^- voltages, (e) the equations for the phasor current $I_s(z)$ & voltage $V_s(z)$ along the transmission line, and (f) the time-domain equations for the current $I(z,t)$ & voltage $V(z,t)$ along the transmission line.
5) For the previous problem, if l = 40 cm, determine: (a) the electrical length of the transmission line βl (degrees & radians) as well as its length in terms of wavelengths, (b) the load reflection coefficient Γ_L, (c) the load impedance Z_L, (d) SWR, and (e) the phasor load voltage V_L & current I_L.
6) An RG-6 coaxial transmission line ($Z_0 = 75\ \Omega$, $u = 2\times10^8$ m/s, α = 9.51 dB/100 m) of length 570 cm is terminated with a load. Using a vector network analyzer (VNA), a load reflection coefficient of $\Gamma_L = 0.5\angle{-44°}$ is measured. The transmission line is connected to a generator with $V_g = 36\angle0°$ V and $Z_g = 68\ \Omega$ operating at 100 MHz. Draw the TL circuit. Then, determine (a) the attenuation (Np/m), phase (rad/m), & propagation constants, (b) SWR & load impedance, (c) input reflection coefficient & impedance, (d) phasor input current & voltage, (e) phasor forward voltage wave amplitude, and (f) phasor load current & voltage.

Due Wednesday, September 18, 2024.

Note: Express currents, voltages, and reflection coefficients in polar/phasor format with angles in degrees (e.g., $0.4\angle66°$). Express impedances in rectangular format (e.g., $22 - j44\ \Omega$).