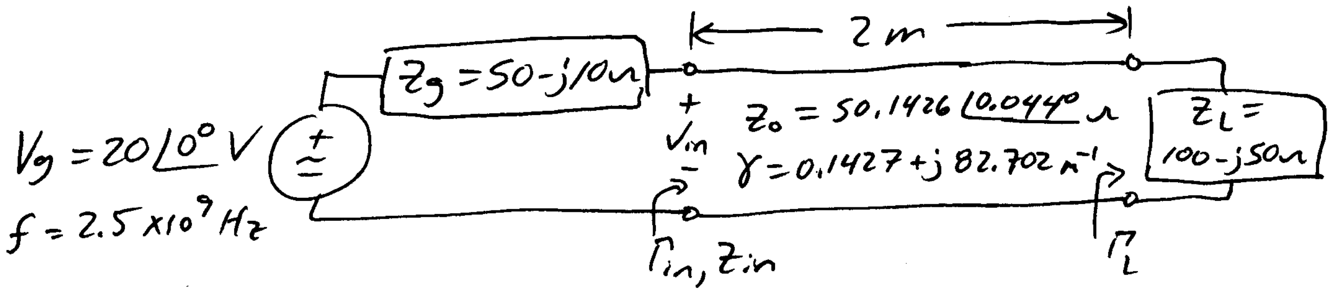
Use a 2 m length of the Victorian coaxial transmission line to create a TL circuit with $V_g = 20\angle 0°$ V, $Z_g = 50 - j10\ \Omega$, and $Z_L = 100 - j50\ \Omega$ operating at 2.5 GHz. Find: a) the load reflection coefficient, b) input reflection coefficient, c) V_0^+, d) the general phasor voltage & current equations.



a) (2.35) $\Gamma_L = \dfrac{Z_L - Z_0}{Z_L + Z_0} = \dfrac{(100 - j50) - (50.1426 + j\,0.0381)}{(100 - j50) + (50.1426 + j\,0.0381)}$

$$\Gamma = \Gamma_L = 0.4464\angle -26.6981°$$

b) (2.90) $\Gamma_{in} = \Gamma(\ell) = \Gamma_L e^{-2\gamma\ell} = (0.4464\angle -26.70°)\,e^{-2(0.143 + j82.7)2}$

$$\Gamma_{in} = 0.2523\angle 99.3733°$$

c) $Z_{in} = Z_0 \dfrac{1 + \Gamma_{in}}{1 - \Gamma_{in}} = (50.1426\angle 0.044°)\left(\dfrac{1 + 0.2523\angle 99.37°}{1 - 0.2523\angle 99.37°}\right)$

$= 40.96 + j\,21.8158\ \Omega$

By voltage division $V_{in} = V_g \dfrac{Z_{in}}{Z_g + Z_{in}} = (20\angle 0°)\dfrac{40.96 + j21.816}{(50 - j10) + (40.96 + j21.816)}$

$$V_{in} = 10.1189\angle 20.639°\ V$$

$V_0^+ = \dfrac{V_{in}}{e^{\gamma\ell} + \Gamma_L e^{-\gamma\ell}} = \dfrac{10.1189\angle 20.639°}{e^{(0.143 + j82.7)2} + 0.4464\angle -26.7°\, e^{-(0.143 + j82.7)2}}$

$$V_0^+ = 7.6783\angle -110.876°\ V$$

d) (2.89a) $V(z) = V_0^+\left[e^{-\gamma z} + \Gamma e^{\gamma z}\right]$

$$\underline{\underline{V(z) = \left(7.678\angle{-110.88^\circ}\ V\right)\left[e^{-(0.143+j82.7)z} + \left(0.4464\angle{-26.7^\circ}\right)e^{(0.143+j82.7)z}\right]}}$$

$$(2.89b)\quad I(z) = \frac{V_0^+}{Z_0}\left[e^{-\gamma z} - \Gamma e^{\gamma z}\right] = \frac{7.678\angle{-110.88^\circ}}{50.1426\angle{0.044^\circ}}\left[e^{-\gamma z} - \Gamma e^{\gamma z}\right]$$

$$\underline{\underline{I(z) = \left(0.1531\angle{-110.92^\circ}\right)\left[e^{-(0.143+j82.7)z} - \left(0.4464\angle{-26.7^\circ}\right)e^{(0.143+j82.7)z}\right] A}}$$

Both valid for $\underline{\underline{-2\,m \le z \le 0}}$