Quiz 4

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E&M II
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Name:

Prob. 1(4)

A lossy transmission line is characterized by L, C, R and G, inductance, capacitance, resistance and conductance per unit length, respectively.

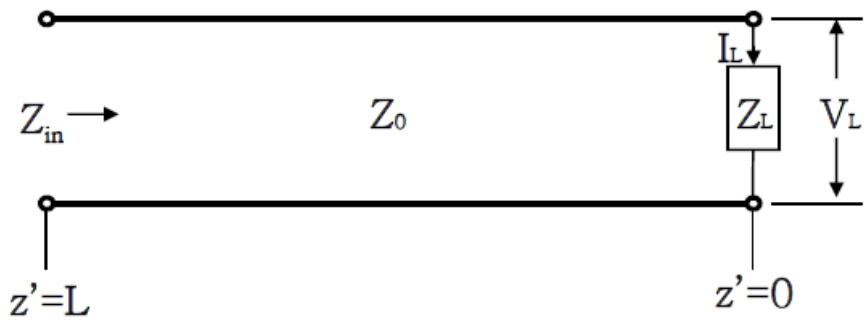
(a)(2) Using the equivalent circuit model, derive the voltage transmission wave equation in the ω-domain.

(b)(1) If a DC ($\omega = 0$) voltage of V_0 is connected to the transmission line at z=0 and the transmission line is infinitely long into the z-direction, what is the voltage as function of z?

(c)(1) What is the characteristic impedance of the transmission line for the case given in (b)?

Prob. 2(3)

A lossless transmission line is connected to a short circuit as shown below (Z_L = 0).



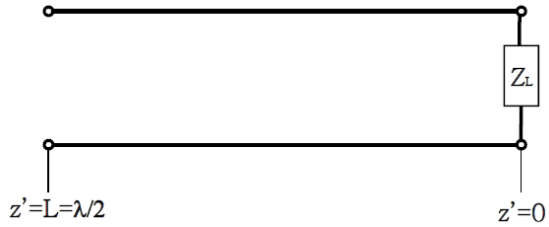
(a)(1) Determine the smallest value for z' where the current wave is zero. Give your answer in terms of λ, the wavelength.

(b)(1) Determine the smallest positive value for z' where the voltage wave is zero. Give your answer in terms of λ, the wavelength.

(c)(1) What is the standing wave ratio for the above transmission line circuit?

Prob. 3(4)

A sinusoidal voltage signal with angular frequency ω_0 is applied to a lossless transmission line with characteristic impedance R_0 and a load impedance Z_L. Assume the length of the transmission line is $\lambda/2$, where λ is the wavelength of the voltage wave on the transmission line.



For each type of the load given below, sketch $|V(z')|$ or $|I(z')|$ for $z'= 0$ to L. Make sure the locations for the maximum and minimum values are clearly indicated in your sketches.

(a)(2) Sketch $|V(z')|$ if the load is a capacitor with capacitance $C = 1/ (\omega R_0)$.

(b)(2) Sketch $|I(z')|$ if the load is an inductor with inductance $L = R_0/\omega$.