ECE 546   HOMEWORK No 5   Due Friday, March 13, 2026

1. Write a code to simulate the response of a lossy twisted-pair 100-meter cable terminated with linear resistive loads. Test your program using the example shown below. Use $Z_1 = 50\ \Omega$ and $Z_2 = 10\ \text{k}\Omega$.

The characteristic impedance of the lossy line is given by $Z_o(f) = \sqrt{\dfrac{Z(f)}{Y(f)}} = \sqrt{\dfrac{R + j\omega L}{G + j\omega C}}$

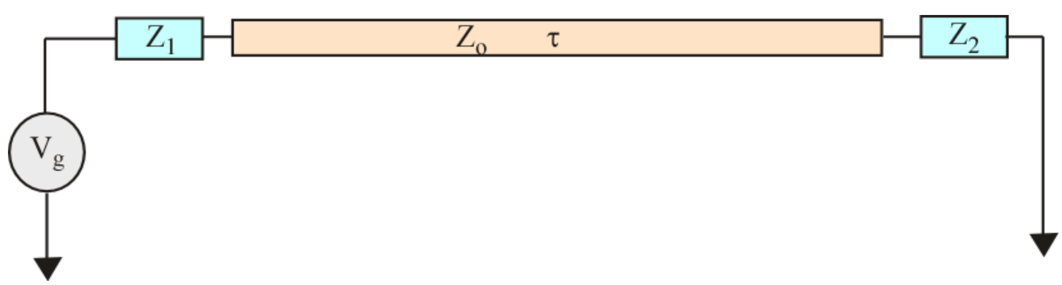
The propagation constant is $\gamma = \sqrt{Z(f)Y(f)} = \sqrt{(R + j\omega L)(G + j\omega C)} = \alpha + j\beta$

The parameters of the cable are L = 145 nH/m, C =14 pf/m. Ignore the dielectric loss (G = 0). The skin effect resistance is: $R_o = 5.0\ \Omega / m - \sqrt{GHz}$. Show near and far end plots for two different loss models:

(a) $Z(f) = R_o\sqrt{f} + jL\omega$

(b) $Z(f) = R_o\sqrt{f} + jR_o\sqrt{f} + jL\omega$

Which model is correct? Why?



The pulse characteristics for $V_g(t)$ are as shown in the figure below, with time delay: t_d = 5 ns, rise time: t_r = 2 ns, fall time: t_f = 2 ns, pulse width: t_w = 20 ns, pulse amplitude: V_{max} = 1 volt