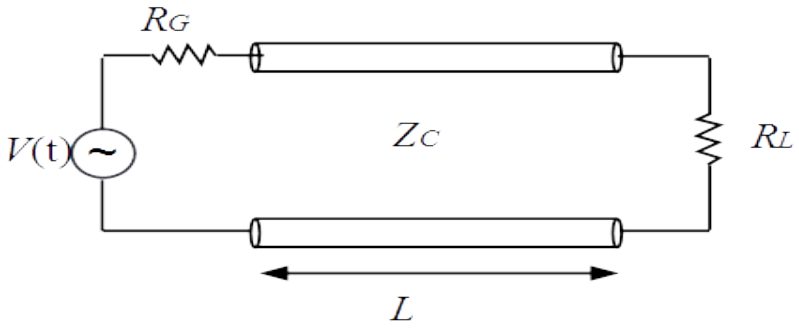
Wave transmission – MATLAB project 1

Goal: The goal in this subject is to compare the reverberations solution and the steady-state solution, and to explore how the former reduces to the latter.

Problem Formulation: We consider the transmission line configuration depicted below. The line parameters are: $v = 3*10^8$, $Z_C = 100\,\Omega$, and the line length is $L = 1m$. The generator signal is $V(t) = \sin(\omega t)\cdot u(t)$ where $u(t)$ is the unit step function, $\omega = 2\pi f$, $f = 1\,\text{GHz}$, and $R_G = 200\,\Omega$. The load is $R_L = 50\,\Omega$.



Part I: reverberation solution

A. Write the general reverberation solution for the voltage $V(z,t)$ in the line for $0 \le t < \infty$

B. Plot the voltage $V(z,t)$ at $z=L/2$ as a function of time for

$0 \le t \le 2T$, $2T \le t \le 4T$, $8T \le t \le 10T$, $T = L/v$.

C. Plot the voltage $V(z,t)$ as a function of t z along the line for $t = T/2,\quad 3T/2,\quad 10T$.

Pay attention to the formation of "standing waves" for large t

Part II: Stead-state solution

D. Assume now that $V_g(t) = \sin(\omega t)$ has been turned on at $t=-\infty$. Derive the general expression for the phasor voltage $\tilde{V}(z)$ and then for $V(z,t)$ in the line using time-harmonic circuit theory.

E. Repeat items B and C for the voltage calculated in item D, and compare the results.

Submission Guidelines

1. The project is performed and submitted in couples, but students may also do it by their own.
2. All answers should be explained.
3. Attach your code at the end of the report.
4. All couples will be examined on the project. Please bring the hard copy of your report to the exam.
5. Submission via MODEL