PHYS 375: Lab 5 – Signal transmission & impedance matching

Purposes
Get familiar with signal transmission and reflection. Experimentally test the concept of impedance matching.

1 Transmission & Reflection

Setup the signal generator to provide square signals with an amplitude of approximately 1 V and a frequency of about 200 kHz. Adjust the “duty cycle” of the signal generator to give a square signal that is positive for 1 µsec only. Connect a long coaxial cable (our cable are RG-58 with 50 Ω impedance) as shown in Figure 1

![Figure 1: Circuit for parts 1 and 2.](image)

1. Do not terminate the circuit (i.e. do not put any resistance $R$ in Figure 1) but let the circuit open.
   
   (a) make a sketch of the signal you observe on the oscilloscope and try to interpret your observations. Try to put two long coax cable together and describe how the signal change (and explain).
   
   (b) From this observed signal, try to estimate the velocity of the signal in the cable.

2. Terminate the circuit with various resistors ($R=1000, 330, 100, 47, 22, 10, 0$).
   
   (a) For each value of $R$ estimate impedance of the cable (using the observed signal on the oscilloscope – the reflection ratio is a function of $R$ and of the impedance of the cable).
   
   (b) How does the computed impedance value(s) compare to the quoted cable impedance (50 Ω).
2 Impedance Matching

Using the same circuit as in the previous section, replace the coaxial cable with an “audio”, or double-parallel wire, cable (the impedance of this cable is 300 Ω).

1. Repeat steps 2-(a) and 2-(b) of the previous section to measure the impedance of the cable.

2. Modify the circuit to include two resistors (270 and 55 Ω) as shown in Figure 2.

3. Discuss the purpose of these two resistors.

4. Redo step 2-(b) of the previous section. What is the difference compare to the case where the two resistors were not in the circuit?