RF Lab (Part I)

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1 Objectives

To observe the transient phenomenon of terminated coaxial transmission lines in order to study their time domain behaviour.

Using the LabVIEW runtime engine measure for different input dc voltages and taking same other parameters (e.g. load resistance, generator resistance R_g,length of the transmission line)the saturation voltage in the transmission line and compare it with the theoretically calculated values.

To plot the reactive load components, the V_1^+ and the reflected wave V_1^- with varying input voltages and compared with the theoretical values.

2 Observations

Here characteristic impedance of the transmission line R_0=50Ω,Load resistance R_L=150Ω and Generator resistance R_g=100Ω.

$$\Gamma_L = \frac{R_L - R_0}{R_L + R_0} = \frac{100}{200} = 0.5 \tag{2.1}$$

$$\Gamma_g = \frac{R_g - R_0}{R_g + R_0} = \frac{50}{150} = 0.33 \tag{2.2}$$

$$V_L = (\frac{1 - \Gamma_L}{1 - \Gamma_L\Gamma_g})V_0 = 0.5988V_0 \tag{2.3}$$

where the Γ_L=reflection coefficient at the load end.
Γ_g=reflection coefficient at the generator end.
V_L=Voltage in transmission line after long time.

Table 2.1: Simulated and theoretically calculated voltage data for resistive load

V_0(in V)	V_L(simulated) in V	V_L(calculated) in V
5	3.0	2.99
10	6.0	5.99
15	9.0	8.98
20	12.0	11.98
25	15.0	14.97
30	18.0	17.96
35	21.0	20.96
40	24.0	23.95
45	27.0	26.95
50	30.0	29.94

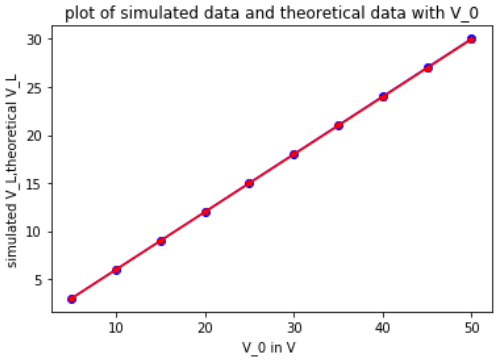

Figure 2.1: Theoretical and simulated V_L with V_0 according to the above table

3 Conclusions

In the resistive load the load voltage comes out to be in a linear relation with source voltage. For resistive load the reflection coefficient is a constant at both ends of the transmission line and there is no change in phase in the voltage wave upon reflection. Hence after a long time the waves together saturates to a certain value which is found by the above equations.In case of inductive load there is a 180 degree phase change so the total voltage in transmission line goes to zero after long time and in case of capacitive load in phase interference of the wave leads to appearance of the V_0 as the total voltage in the transmission line.

4 Acknowledgement

The experiment, theory, procedure and simulations are taken from the Virtual Labs – IIT Kanpur:`http://www.iitk.ac.in/mimt_lab/vlab/`.
