ECE320: Fields and Waves

Lab 1 Report: Waves on Transmission Lines

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1 Introduction

This assignment was about exploring the characteristics of transmission lines (abbrv. T.L.), studying voltage and current propagation along the T.L.s, as well as depedance on loads.

Introduction to the lab and its purpose. The following is the reflection coefficient for a transmission line

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0}$$

2 Determining the Characteristic Impedance, Z_0

We varied the load on the switch box until we saw little or no traces of reflected waves. This was at $Z_L = 50\Omega$ which is also equal to the charactertic impedance since we know that the reflections nullify when $Z_L = Z_0$. The corresponding waveforms captured at the generator input (channel 1, yellow) and the transmission line input (channel 2, green) are shown in Figure 1.

Figure 1: Transmission line terminated with load equal to Z_0

3 Determining Z_0 using $\frac{\tilde{V}^+(z=0)}{\tilde{I}^+(z=0)}$

As seen in the picture the voltage at v_g is 154mV and v_1 is equal to 51mV. Assuming the resistance in between is 100Ω $i_l = \frac{0.154-0.051}{100} = 1.03 * 10^-3$A. Which means $Z_0 = \frac{v_1}{i_l} = \frac{0.051}{1.03*10^-3} = 49.51\Omega$ 50Ω

4 Observation of Travelling Waves

We know that the phase velocity of an electromagentic wave in space with magnetic permeability, μ, and electric permittivitty, ϵ is given by:

$$v_p = \frac{1}{\sqrt{\mu\epsilon}}$$

5 Conclusion

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