University of Victoria

ELEC 340

Applied Electromagnetics and Photonics

Lab 3 - Normal Incidence and Reflection Transmission

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A01 - B03

March 9, 2016

1 Objective

Upon completion of the lab you should be able to:

1. Have a good understanding of the electromagnetic theory that governs the reflection and transmission of uniform plane waves at normal incidence.
2. Use computer software and smith charts to solve reflection and transmission problems.
3. Design electromagnetic impedance transformers.

2 Introduction

This lab uses a parallel plate wave guide filled with two different dielectrics to investigate reflection and transmission. When a uniform plane waves hits the boundary between two different dielectrics part of it is transmitted into the second medium and part of it is reflected back. The reflected wave interferes with in incident wave and creates a standing wave. This process is shown in Fig. 1.

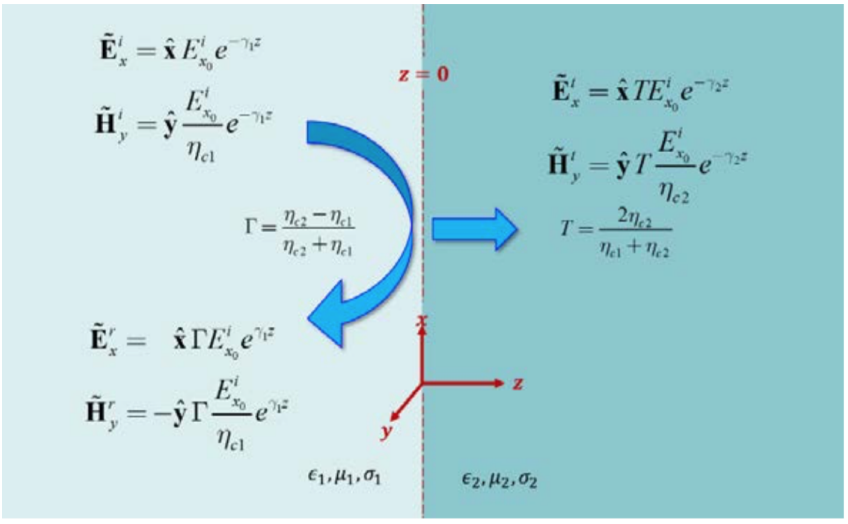

Figure 1: Reflection and transmission of a uniform plane wave at a normal material boundary

The reflection and transmission coefficientcs, Γ and T, are given by:

$$\Gamma = \frac{E_{x0}^r}{E_{x0}^i} \qquad T = \frac{E_{x0}^t}{E_{x0}^i} \tag{1}$$

The total electric and magnetic fields in the first material will be the sums of their incident and

reflected components. If the phase of the reflected wave is not $\pm 90°$, the total field will have both a traveling and a standing component. The magnitude of the total wave will be bounded by $E_{x0}^{i}\left(1 \pm |\Gamma|\right)$.

For multiple boundaries, this analysis can be applied recursively starting at the medium furthest from the incident wave and working towards it.

3 Procedure

Overview of lab sequence.

4 Discussion

Analysis and interpretation of data.

5 Conclusion

Summarize the entire report and note any unresolved issues. This section will usually repeat the abstract.