

**DESIGN AND CHARACTERIZATION OF A 3dB SLOTTED WAVEGUIDE  
COUPLER**

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**Final Year Project Report Submitted in  
Partial Fulfillment of the Requirements for the  
Degree of Bachelor of Science (hons.) Physics  
In the faculty of applied sciences  
Universiti Teknologi MARA Malaysia**

**NOVEMBER 2008**

## **Acknowledgement**

In the name of Allah SWT, the Beneficent, the Merciful, all praise to Allah SWT for all incredible gift endowed upon me and for giving the health and strength to proceed the study and enable me to complete my thesis.

I would like to take this opportunity to express my sincere appreciation and gratitude to everyone who has contributed either directly or indirectly throughout this project especially to my supervisor, Mr Mohd Hanapiah Bin Mohd Yusoff for the consistent consultation and valuable advice. His encouragement, comments and constructive ideas built my mind to generate this thesis in proper way.

Deep appreciation to my beloved family for their logical ideas, moral and money support, prayers, expectations and love in nurturing me to be who I am today, and also for their encouragement that has enable me to succeed.

Last but not least, credits to all my friends for their ideas, suggestions and assistance in completing this thesis. Thanks to all that provide minor and major contribution which has been the constant source of this thesis.

*“May Allah bless and reward them for their generosity”*

## Abstract

An optical waveguide is a physical structure that guides electromagnetic waves in the optical spectrum. Common types of optical waveguides include optical fibre and rectangular waveguides. Optical waveguides are used as components in integrated optical circuits or as the transmission medium in local and long haul optical communication systems. Optical waveguides have several geometries such as planar, strip or fibre waveguides. It has two different modes which are single-mode and multi-mode. Different refractive index also makes them different from each other. Mostly, optical waveguides are made of material such as glass, polymer or semiconductor. A conventional Silica optical waveguide power splitter based on directional coupler is one of an important waveguide for producing an optical network. Unfortunately, its size would normally be in cm long. Nowadays, small gadgets are highly demanded. People start choosing smaller products than large products produced last time. Hence, compact component also became highly demanded. In order to overcome the weakness in size of conventional Silica optical waveguide power splitter, 3dB slotted waveguide coupler which is expecting to be more compact than conventional Silica waveguide will be investigated. Then, its polarization effects such as TE and TM will be investigated. In that case, 3dB slotted waveguide will be designed. and its input and output will then be characterized.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Optical signals distribution network are optical clock signal distribution in computer and optical network to houses, offices and premises. Optical clock signal distribution in computer is time synchronization which has been used by each component in the computer. Further, optical network has been used by most of the telecommunication system to transfer information to houses, offices and premises. All of these optical signals distribution are made of fibre optics which is more expensive but high in technology compared to copper wire which has been used since so many decades. Fibre optics use light wave which is high in frequency and travel with light velocity,  $3 \times 10^8$  m/s. Its bandwidth is higher and broad, enable more information being transferred. If all copper wires being substitute with fibre optics, gradually, all optical networks would be established. Hence, all information would be transferred easier and faster, appropriate to the world technology development.

### 1.2 Objective

The main objective of this project is to investigate new design for Silica waveguide power splitter based on directional coupler using horizontal slotted structure and expect it to be more compact than conventional silica waveguide directional coupler. The second objective is to investigate the polarization properties of the 3dB slotted waveguide coupler.

### 1.3 Organization of the Thesis

This thesis consists of six chapters. Chapter 1 represents the introduction and the objective of the project. The second chapter is literature review which relates about 3dB slotted waveguide, its importance. Next chapter is elaborate on the basic theory used in performing this project. The fourth chapter is the overview chapter which relates the effective index method (CAMFR), eigenmode expansion method and analysis of waveguide. Chapter