INVESTIGATION ON SELECTIVE EXCITATION OF 200μm POLYMER CLADDED SILICA(PCS) WAVEGUIDE USING EIGENMODE EXPANSION METHOD

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Abstract

A waveguide or an optical waveguide is the media for light to propagate through inside an insulator. The light or the electromagnetic wave is confined inside the waveguide so that it will flow direct to the next end of the waveguide. There are several types of optical waveguide which is widely used today such as circular, rectangular, tapered and slotted. All of these produce different types and forms of outputs. A waveguide can be compared by its size, where the smaller one, which is nanometer in size, mostly produces single mode wave propagation. The bigger size will have multi-mode wave propagation inside but depends to the beam size. Fiber optics consists of strings of optical waveguide which is prominent as the information transfer medium. It is widely used today inside vehicles as the information and entertainment data medium conveyor. The optical network system requires high efficiency data transportation. Self-imaging and splitting mechanism was investigated to provide better efficiency even in a highly multimode waveguide. Both of the phenomena occurred due to the multimode interference(MMI) inside the waveguide. In this thesis, a highly multimode waveguide of dimension 200μm×2μm was designed using refractive index of 1.456 for its core and 1.444 for its cladding. The waveguide was excited by Gaussian beam of various sizes. The results obtained show that both self-imaging and splitting mechanism still occur even though the modes were excited using Gaussian beam. Therefore, self-imaging still holds through even in a highly multimode waveguide.

Chapter 1

Introduction

1.1 Background

Fiber optic is no more strangers to the communication and data transportation industry. With the unlimited application and increasing number of demand, there is no doubt that fiber optic is one of the most expanding technology in the world.

In recent years, through research and development, many types of fiber optic produced. Each of the fiber optic produced is specific to certain specifications which suit the environment, whether the fiber optic is going to put inside vehicle, undersea cable, in the emergency room or across buildings.

Most recent application of optical fiber is in the automotive industry. One of the first network-enable device in a car is Controller Area Network (CAN). CAN was developed during 1980s and introduced in 1992. CAN have the capabilities to transport data at different rates from 125 to 500 kb/s. The application of CAN including the antilock-breaking systems (ABS) and the electronic stability program (ESP).[1]

CAN did really change the scenario of the automotive industry around the globe. Customer now demanding for more intelligent system inside their vehicle. Thus, lots of beyond expectation technology emerged in the automotive industry such as drive-by-wire driving, rain and light sensors, electronic braking distribution (EBD), park-assist etc.[1]