Nasir Ganikhodjaev
Farrukh Mukhamedov
Pah Chin Hee

VOLUME 1

$$x' = 2xy$$
$$y' = 2xz$$

INVESTIGATIONS ON PURE MATHEMATICS, FINANCE MATHEMATICS AND OPTICS

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$$\varphi_1(x, y, z) = z$$

$$z' = x^2 + y^2 + z^2 + 2yz$$

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Part II Finance Mathematics Concentration

Part III Optics Concentration

LINEAR WAVE PROPAGATION IN SINGLE MODE OPTICAL FIBRE

Mohammad Rodhi Shahar
Assoc. Prof. Dr. Bakhram Umarov

Abstract. *In this project paper we simulate the wave propagation in single mode optical fibre. The two dimensional finite difference beam propagation method (2D FD-BPM) was utilized. The 2D FD-BPM was discussed comprehensively throughout this paper. Our simulation suggests that the wave intensity degenerates with respect to propagation length.*

1 Introduction

Nowadays, optical fibres have become an important asset especially in communication systems. Therefore, analysis on guided wave has gradually become essential. One of the important analyses is on the wave propagation through various waveguide structures such as optical fibres, switches and couplers. Through the decade, various techniques were introduced to analyse the wave propagation either analytically or numerically. In this project, we are interested in simulating the wave propagation of single mode optical fibres. We will utilize the two dimensional finite difference beam propagation method (2D FD-BPM) for the simulation purposes.

1.1 The standard single mode optical fibres

An optical fibre is usually made out of high quality glass with a core, cladding and protected with a buffer or outer jacket. The core has either a uniform or graded refractive index with the cladding having slightly different refractive index. Today, single mode fibres are utilized in most telecommunication systems. A single mode fibre only supports one guided mode usually known as the fundamental mode. In most application, a step-index single mode fibre is favoured since the optical field is largely confined to the core. The core usually have width between 8 to 12 μm and a cladding of 125 μm. Figure 1.1 (a) shows a typical standard single mode fibre cable and in figure 1.1 (b) shows the light path of a single mode optical fibre.

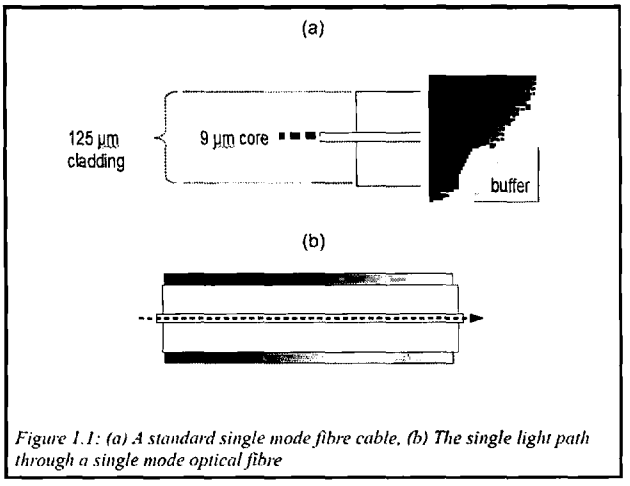

Figure 1.1: (a) A standard single mode fibre cable, (b) The single light path through a single mode optical fibre

There are a few international fibre optic standards defined which standardize the cable type to be used for various applications. For example, the IEEE fibre optic standards defines a single