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Micro-Optics

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ABSTRACT: *This research work deals with the implication of modern retailing at not only in Dhaka, Bangladesh but also the whole district in Bangladesh with main objectives to find out technological activity, impact on modern welfare..*

Keywords: *Polishing, Propagation, Dispersion, Formulation, Coupling efficiency*

I. INTRODUCTION

Micro-optics are optical systems that are between a few micrometres and a millimetre in size. This includes small lenses or arrays of lenses, or optical fibres with a microscale core diameter. Such small optical components are important for integrated optics.

II. HEADINGS

Precision Micro-Optics facilitates is the technological innovations by quality products, exceptional service**,** competitive pricing and on-time delivery. Precision Micro-Optics is an emerging company with world-class entrepreneurs backed by experienced engineers.

III. INDENTATIONS

Precision Micro-Optics highly experienced teams are able to provide you excellent modeling and automatic measurement services, dicing, polishing and coating services. The modeling will be able to optimize your designs, analyze your problems, explore your design limits, and in particular, speed up your process. Dielectric coating features high power handling, while dicing and polishing are able to be manufactured on miniature optical parts.

Optical Field Propagation

Like all electromagnetic phenomena, the propagation of optical fields in a linear/nonlinear, dispersive/nondispersive, homogeneous/inhomogeneous or isotropic/anisotropic media in a guided/unguided structure is governed by Maxwell's equations. It includes a wide spectrum. For each specific case, a basic equation is obtained such as the nonlinear Schrodinger equation (NSL) for pulse propagation in a waveguide, or the paraxial Helmholtz Equation for beam propagation in free space. The equations usually are nonlinear partial differential equations that do not have analytical solutions except for some specific cases. A numerical approach is often necessary to understand the nonlinear, dispersion and other effects. Taking the pulse propagation in a waveguide as an example, one widely used method to solve NSL equation is the split-step Fourier method. The split-step Fourier method assumes that the dispersion and nonlinear effects can be pretended to act independently over a small distance dz. More specifically, pulse propagation form z to z+dz is carried out in two steps. The nonlinearity acts alone in the first step while the dispersive effect act alone in the second step indicated in figure 1 flow diagram.

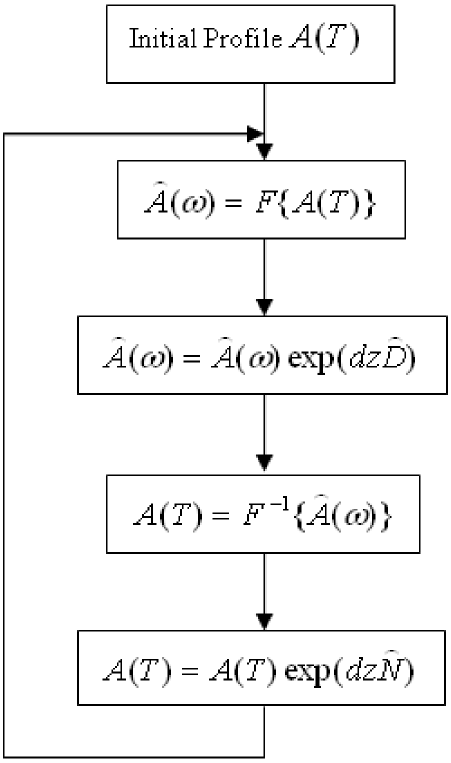


Figure 1: Schematic flow diagram of the computational procedure of the split-step Fourier method.

Features:

- Customized numerical simulation services for your applications
- Visualized image of optical field evolution in the frequency domain and the time domain.
- Experienced engineers are able to deliver a fast service

Example 1: Third-order Dispersion Effect

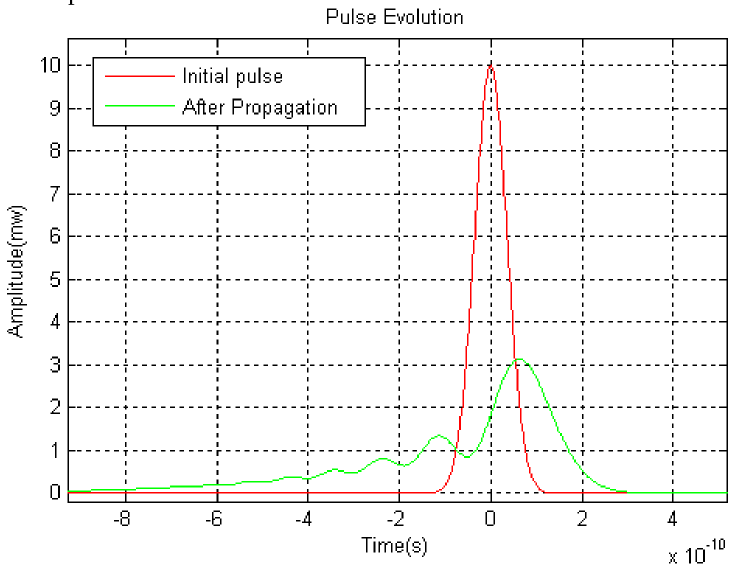


Figure 2: Pulse oscillation induced by the third-order dispersion

T_0 : Pulse width 50 ps

β_2 : Second-order propagation constant $-2.0\times10^{-23}\ \sec^2/km$

β_3 : Third-order propagation constant $-1.2\times10^{-33}\ \sec^3/km$

z : Propagation distance 800 km

Example 2: Cross-phase Modulation

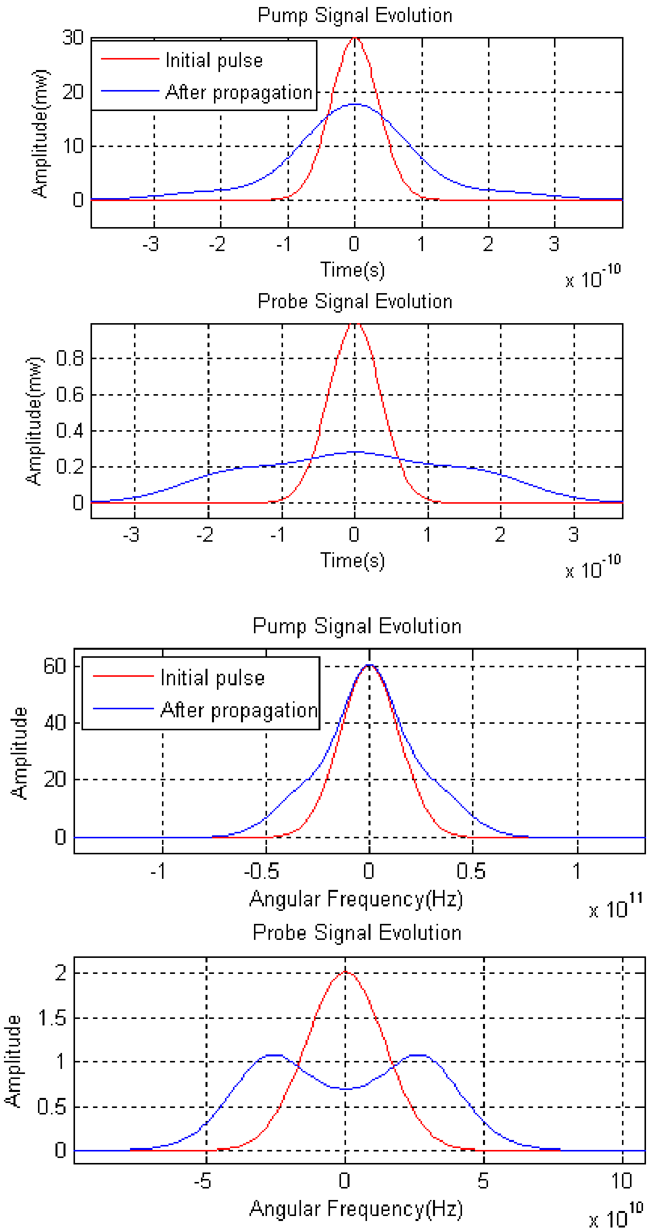


Figure 3: both pump and probe pulse evolution in both time and frequency domains

T_0 : Pulse width 50 ps

β_2 : Second-order propagation constant $-2.0\times10^{-23}\ \sec^2/km$

α : Fiber loss coefficient 0.1 dB

Amplifier gain: 30 dB

Pump peak power: 30 mw

Probe peak power: 1 mw

γ : Nonlinear coefficient $0.0012/_{km\cdot mw}$

z : Propagation Distance 300 km

Figure 3 shows both pump and probe pulses' evolution and assumes both pulses have same polarization. The probe pulse experiences a much bigger broadening in both time and frequency domains induced by cross-phase modulation.

Polarization Evolution

The Jones vector, developed by R. C. Jones in 1941, represents efficiently the polarization state of a plane wave. A Jones vector is given:

$$E = \begin{pmatrix} E_x e^{i\sigma_x} \\ E_y e^{i\sigma_y} \end{pmatrix} \quad (1)$$

It contains complete information about the amplitudes and the phases. When an optical system, such as polarization scrambling, consists of several optical elements oriented at different azimuth angles, the calculation of the overall transmission becomes complicated and is greatly facilitated by a symmetric approach. The Jones calculus is a powerful 2X2 matrix formulation. In this method each optical element is represented by a 2X2 matrix. The overall matrix for the whole system is obtained by multiplying all the matrices, and the output beam polarization state is achieved by multiplying the overall mall matrix and input beam Jones vector. Moreover, the polarization state evolution is able to be visualized on Poincare sphere surface.

Features:

- Customized numerical simulation services for your applications
- Visualized image of polarization state evolution on Poincare sphere surface.
- Experienced engineers are able to deliver a fast service

Example 1: Polarization Scrambling

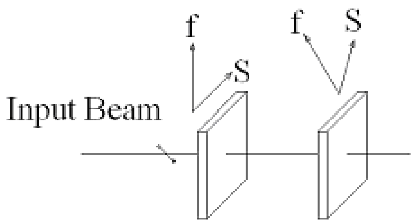


Figure 1: A polarization scrambling configuration by two variable wave plates

Polarization is a fundamental property of light. It is an important factor in an optical system design, such as polarization related impairments in a high bit rate optical communication system induced by the polarization mode dispersion (PMD). Variable wave plates are able to be used to analysis the polarization or scramble it to mitigate the impairments. Figure 1 shows a polarization scrambling configuration by two variable wave plates orientated at a 45 azimuth with each other. The variable wave plates could be LiNbO3 by using electro-optical effect or liquid crystal. Each wave pate has a maximum 2π phase retardation. The second wave plate is modulated 10 times faster than the first waveplate and has a maximum 2π phase retardation every 0.1 second. The initial polarization is a linear polarization which has 45° with respect to slow axis of the first wave plate. Figure 2 shows the polarization evolution on Poincare sphere surface. If a polarizer is placed after the second wave plate and aligned with slow axis of the first wave plate, the output intensity is modulated periodically and figure 3 shows attenuation verse time curve.

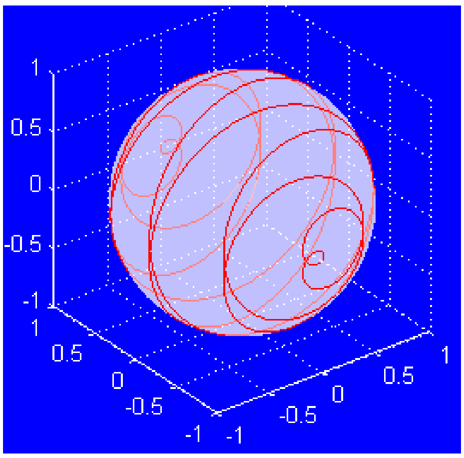


Figure 2: Polarization evolution on Poincare sphere surface

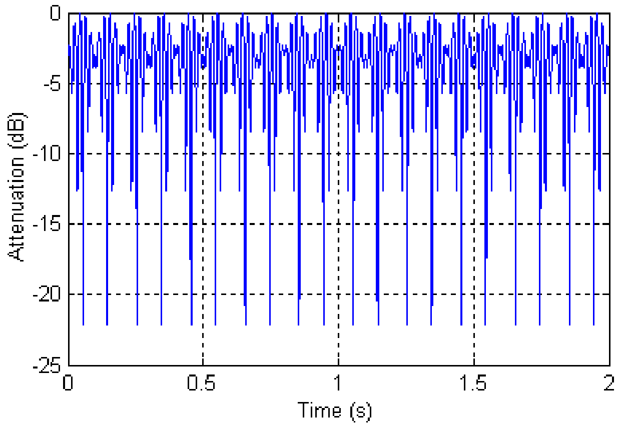


Figure 3: Attenuation verse time

Coupling-loss characterization of Gaussian beams

The Gaussian Beam is a solution of the Paraxial Helmholtz Equation. Its wavefront normal makes a small angle with z axis, the propagation direction. An expression of the Gaussian Beam complex amplitude is given:

$$E(x,y,z) = E_0 \frac{w_o}{w(z)} \exp\left(-\frac{r^2}{w^2(z)}\right) \exp\left(-j\cdot k\cdot z - j\cdot k \frac{r^2}{2\cdot R(z)} + j\cdot \zeta(z)\right) \tag{1}$$

where

$$w(z) = w_0 \left(1+\left(\frac{z}{z_0}\right)^2\right)^{1/2} \tag{2}$$

$$R(z) = z\left(1+\left(\frac{z}{z_0}\right)^2\right) \tag{3}$$

$$\zeta(z) = \tan^{-1}\left(\frac{\lambda\cdot z}{\pi\cdot w_0^2}\right) \tag{4}$$

$$z_0 = \frac{\pi\cdot w_0^2}{\lambda} \tag{5}$$

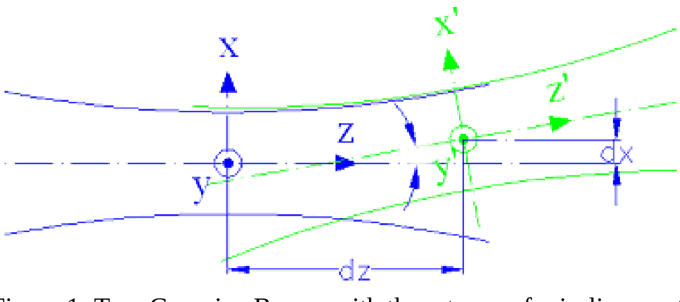


Figure 1: Two Gaussian Beams with three types of misalignment

Figure 1 shows two Gaussian Beams with three misalignments, which are beam separation dz, offset dx and angular rotation θ. The coupling efficiency is expressed as:

$$\eta = \frac{\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} E(x,y,z)|_{z'=0} \cdot E^*(x',y',z')|_{z'=0}\, dx'dy'}{\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} E(x,y,z)|_{z'=0} \cdot E^*(x,y,z)|_{z'=0}\, dx'dy' \cdot \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} E(x',y',z')|_{z'=0} \cdot E^*(x',y',z')|_{z'=0}\, dx'dy'} \tag{6}$$

The coordinate transformation between x, y, z and x ' y', z ' is given by:

$$x = x' \cdot \cos(\theta) - z' \cdot \sin(\theta) + dx \quad (7)$$

$$z = x' \cdot \sin(\theta) + z' \cdot \cos(\theta) + dz \quad (8)$$

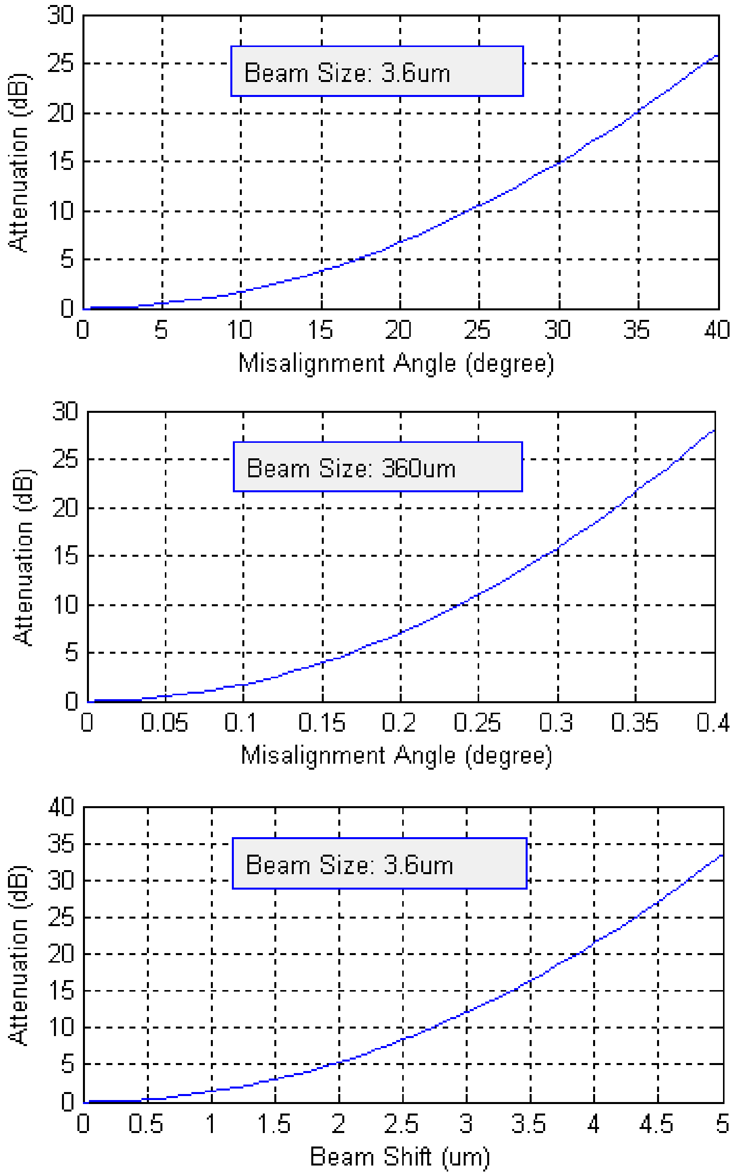
$$y = y' \quad (9)$$

The general formula here provides us the tools to numerically compute the coupling efficiency and its sensitivity due to different misalignments, phase distortion to spot mismatching.
Features:

- Customized numerical simulation services for your applications
- Coupling efficiency and its sensitivity analysis
- Experienced engineers are able to deliver a fast service

Example: Coupling Efficiency Sensitivity Analysis

Figure 2 shows the coupling loss verse offset and angular rotation for two beam sizes of 360 microns diameter at the left and 3.6 microns diameters at the right. The wavelength is 1550nm. The results indicate that a bigger beam size is less sensitive with offset and a smaller beam size is less sensitive with angular rotation, while the product of offset and angular rotation is an almost constant..



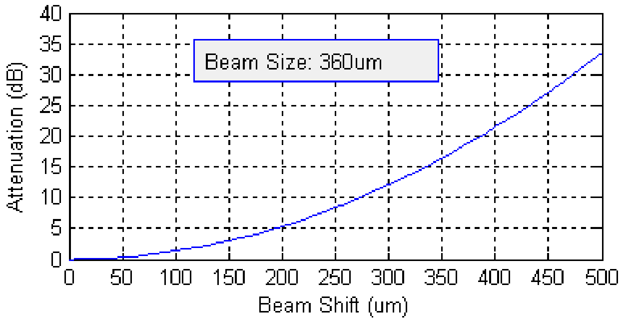


Figure 2: coupling loss verse offset and angular rotation for two beam sizes of 360 and 3.6 microns diameter

Moticam X and Moticam 580 Digital Cameras

- Moticam X digital cameras allow students or instructors to wirelessly connect to the live microscope image with a Wifi-enabled tablet, smart phone, or PC/laptop
- Moticam X is priced with the intent of allowing every microscope to be outfitted with a camera
- Moticam 580HD is a stand-alone microscope camera designed for feeding a live HDMI video stream to an HD projector or monitor
- These cameras can be equipped to any trinocular microscope whether compound or stereo, or can be ordered together with

Motic BA210 Elite

- Excellent performing student microscope
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- Rackless stage with ergonomic control
- Freely change between halogen and LED lighting
- Great optical performance
- Priced to compete

Labomed CXL Binocular

- Smaller, more compact microscope
- Acceptable optics
- Ideal for high schools or very tight budgets
- LED lighting
- Quality construction

IV. CONCLUSION

Limitation:

1. Optical field propagation is not possible without nonlinear Schrodinger equation.
2. It's initial polarization is a linear polarization .

Though it has limitations but modern era is very dependable on these. Specially in pharmaceutical sector these are very effective. Hence, all kinds safety for human is possible by this system. So, this system is absolutely welcome for modern era.