PREFACE

Optical system study can be classified under three categories such as conventional, guided wave and integrated microoptics. Conventional microoptics consist of discrete microlenses and other optical devices. Guided-wave optical components basically utilize dielectric planar waveguides or optical-fiber circuitries. Integrated optics is used to construct optical circuits by a monolithic fabrication process. Hence, it seems appropriate to define the term “microoptics” based on the fabrication aspect: microoptic is fabricated by microtechnology.

Optical hardware classified in terms of optics is waveguide optics, free-space optics and combination of waveguide and free-space optics (or integrated optics). In waveguide optics, a light wave is confined by a lateral variation of the refractive index (either using a step profile or a gradient profile). In the longitudinal direction, the propagation medium is usually homogeneous. Lateral dimensions vary from a few micrometers for single mode waveguides to the order of 1 mm for multimode plastic fibers.

Light propagation is simply described by a ray, which indicates a path of light energy. Actually, sometimes a very thin beam from a laser or collimated light through a pinhole appears as a “ray” that is certainly indicating
the path of light energy. In a conventional optical system, which is constructed with lenses, mirrors, prisms, and so on, a ray is represented by a straight line and being refracted or reflected at a surface where refractive index changes. The ray trajectory in a distributed index medium is calculated from ray equations which are second-order partial differential in nature. According to this definition, the tangential direction of the ray corresponds to the direction of the time-averaged Poynting vector. This definition is consistent with Fermat’s principle

The chapter one is the introductory chapter begins with basic classifications of optical hardware’s such as wave guide optics, free space optics and combination of them which is followed by their optical functions and implementations. The implementation of a free-space optical system requires two basic operations: imaging and beam deflection were discussed in brief.

The important characteristics of microlens of interconnect lens system, analysed through the parameters diameter, Point Spread Function, Encircled Energy function, Modulation Transfer Function, Shape of wavefront, off axis performance, radius of curvature of surface and index distribution of graded index lenses etc, were given in chapter two.
In chapter three, the theory of diffraction is outlined which can emphasize the modeling of the aberrations of diffractive lenses through ray tracing is described. It begins with ray equations, ray equation in integral form and finally finds some application of this theory to optical components.

The modern lens design algorithm is used to construct the microlens were described in detail in chapter five. The various aspects of ZEMAX® software - The optical lens Design and Analysis package used to study the performance characteristics of designed lens system discussed with construction of conic microlens were discussed.

Chapter six gives out the detailed description of aberration characteristics of conic microlens for its geometric parameters were analyzed using spot diagram, PSF, OTF and Encircled Energy. Spot diagram of the designed lens system for various values of conic constant with respect to field angle were pictorially represented and discussed. The computer program (SPOTDIAGRAM) that realizes analysis of optical image quality by means of spot diagrams is reported. Theoretically obtained values of third order Seidel coefficients, Zernike coefficients were compared with simulations results of ZEMAX®.
A simple model has been proposed to calculate the LD-SMF coupling efficiency for different axial distance using conic interconnect microlens and its results were compared with reported values in chapter seven. Coupling efficiency is also calculated for varying lens thickness depending on a, b and σ values in single mode fiber.

In chapter eight, the summery of thesis were done based on the finding in chapters 5, 6 & 7. Chapter nine concludes with the best conic microlens to enhance the coupling efficiency between LD-SMF’s.