INVESTIGATION OF GROUP VELOCITY DISPERSION AND POLARIZATION MODE DISPERSION IN MICROSTRUCTURED SILICA WAVEGUIDE

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INVESTIGATION OF GROUP VELOCITY DISPERSION AND POLARIZATION MODE DISPERSION IN MICROSTRUCTURED SILICA WAVEGUIDE

With the advent of practical, long-haul optical fiber links in the 1980s, the need to manage dispersion in an optical communications network arose. In addition to the temporal distortion effects that pulses from mode-locked lasers experienced due to dispersion, a pulse train in a communications link also had to contend with intersymbol interference (ISI) arising from overlaps of adjacent pulses in a bit-stream. The amount of dispersion tolerated by an optical transmission line varies inversely proportionally to the square of the data-rate. For the early 2.5-Gb/s systems, the dispersion tolerance was greater than 30000 ps /nm. Hence a conventional single-mode fiber (SMF), with 17 ps / (km-nm) dispersion could be used for lengths as long as 2500 km without being limited by dispersion. However, as transmission lengths as well as bit rates grew, dispersion became the primary bottleneck that the optical network had to combat. There are huge proposals for dispersion compensation which have their advantages and disadvantages but still, the complete solution is to be found. In this thesis, the dispersion properties of microstructured square core silica waveguide were investigated. We investigated the waveguide geometries such as the waveguide cross-section and gap size and its effect on group velocity, dispersion, and group delay using numerical simulations. It was found that the waveguide cross-section size and gap can be used to control the resulting dispersion. It was also found that microstructure silica waveguide have display the potential of compensating both positive and negative dispersion. The size of the square core in term of its width, w has shown a critical effect on controlling the dispersion properties while maintaining its feature as a single mode waveguide.