

## **Abstract**

In this work conventional incoherent optical asynchronous wavelength-division multiplexing (WDM) communication system is investigated. The practical components of WDM system modules have been implemented through software to understand the behavior of these components and overall system considerations because of the role played by these components in the transmission processes (e.g., optical fiber, continuous wave laser diode (CW), multiplexer (MUX), etc.). Crosstalk limitations, imposed by optical fiber in WDM have been considered. Crosstalk are grouped into two types, known as interchannel and intrachannel crosstalk, where intrachannel-crosstalk is more severe than interchannel-crosstalk. In general, crosstalk arises due to nonlinearities in optical fibers. The nonlinearities in optical fiber are divided into two types, the first group, known as nonlinear scattering such as stimulated Raman scattering (SRS). SRS can be reduced effectively, when channel spacing becomes as close together as possible and keeping of signal power below the SRS threshold. The second group is known as nonlinear refractive index or Kerr effects such as Four-wave mixing (FWM), decreasing channel spacing and chromatic dispersion will increase FWM. In addition, Cross phase modulation (XPM) acting as a crosstalk penalty increases with increasing channel power level, system length increases, with decreasing channel spacing. The nonlinearities in optical fibers depend on many manufacturing parameters such as nonlinear refractive index, effective area of the fiber, dispersion parameter, dispersion slope, and attenuation. These nonlinear effects cannot be completely compensated, but can be reduced. Thus, from multi types of optical fibers, standard single-mode fiber (SSMF) is preferred in WDM system, since it has lower nonlinear tendencies than dispersion shift fiber (DSF) or Non-zero dispersion shift fiber (NZDSF). Practical solutions have been considered to reduce nonlinear effects and as a result reduction crosstalk. Advanced analyses of WDM system take into account the overall effects along an optical fiber link, such as receiver stage that contains dark current, shot noise, thermal noise and also signal impairments due to dispersion, attenuation, ASE noise, and nonlinearities. These analyses are most important key system requirements that govern the performance of WDM system such as fiber length (or possible transmission distance), data rate (or channel bandwidth), and bit error rate are investigated.

*All simulations were implemented using the "Photonic Transmission Design Suite" (PTDS) software package in conjunction with programs written in MATLAB 6.*