ABSTRACT

Fiber nonlinearity such as stimulated Raman scattering, cross phase modulation and self phase modulation imposes a key limitation on WDM communication system. Stimulated Raman scattering causes power transfer from one channel to another while cross phase modulation and self phase modulation causes phase modulation of WDM channels. This modulation of power and phase is denoted as crosstalk. Motivation to investigate the impact of fiber nonlinearity in terms of crosstalk in WDM optical fiber communication link employing lumped and distributed amplifiers has led to derivation of novel closed form formulae. The closed form formulae have been derived using statistical methods. The aim of present research is to analytically study crosstalk in WDM system employing Erbium doped fiber amplifier and distributed Raman amplifier. Impact of bit rate, input power and interchannel separation on crosstalk performance of WDM system has been investigated. It was found that with the increase in bit rate crosstalk decreases whereas with the increase in input power, crosstalk increases. With the increase in wavelength separation, keeping the wavelength range fixed, it was found that crosstalk suffered by the system decreases. Crosstalk due to fiber nonlinearity for three pumping schemes of DRA has also been investigated. Backward pumped DRA has been found to be the best performing DRA from crosstalk point of view. Crosstalk due to nonlinearity in dynamic WDM system employing EDFA has also been studied and found to be very detrimental. 40 Gbps transmission system could not compete on a cost basis with the 10 Gbps system that are already deployed and hence has not been commercially deployed and is limited to research experiments. Advanced optical modulation such as intensity and phase modulation formats is a key technology that can enable building of flexible and cost effective high capacity 40 Gbps optical transmission systems. In the present research work, analytical expressions have been derived for crosstalk for two modulation formats - one intensity modulation format i.e. OOK and other phase modulation format i.e. DPSK. The results based on the statistical analysis show that 40 Gbps RZ-DPSK signal (33.3% duty cycle) in backward pumped DRA offers superlative crosstalk performance in a WDM communication system.