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ASYMMETRIC PULSE DISTORTION DUE TO PULSE WALK-OFF PHENOMENA IN WIDE-BAND DWDM RAMAN AMPLIFICATION SYSTEMS

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Abstract

The performance of wide-band dense wavelength division multiplexed (DWDM) optical communication systems can be degraded by nonlinearities in optical fiber. It has been shown that stimulated Raman scattering (SRS) is the ultimate performance-limiting phenomenon in multichannel optical transmission systems. The performance degradation imposed by stimulated Raman scattering has been previously studied. However, pulse walk-off effect among different channels has been ignored in analyses. To our knowledge there is no treatise which deals with coupled nonlinear equations (with walk-off effect) in case of wide-band WDM Raman amplification systems. In this paper, we investigate the effect of group velocity dispersion on stimulated Raman crosstalk in case of wide-band DWDM transmission systems. We have also provided a scheme to solve the nonlinear-coupled gain equations with pulse walk-off effect. We have tried to gain deeper insight into the functioning of DWDM Raman amplification systems by using the numerical technique called finite difference time domain method. Finally we have provided results of the simulation for some cases. Since pulse walk-off effect is responsible for transient effects in DWDM Raman fiber amplifier (RFA), hence the modeling has also done in this paper to simulate the effect of abrupt channel addition and removal response.

Keywords: Fiber nonlinearity, stimulated Raman scattering, group velocity dispersion, pulse walk-off rate among DWDM channels, finite difference time domain method scheme.