ABSTRACT

The Raman amplifier has been proven to be an effective amplifying device for providing relative flat gains over a wide band making it one of the widely used nonlinear optical devices in telecommunications. Discrete Raman fiber amplifiers (DRFA) are also considered as one of the potential replacements of erbium–doped fiber amplifiers (EDFAs). Besides its amplification to combat the fiber attenuation, the fiber dispersion is also compensated when the dispersion compensating fiber (DCF) is used as the Raman–amplifying medium.

This thesis presents investigation, pump power optimization and performance evaluation of DRFA via OptiSystem–10 software under two different configurations, namely, single–pass DRFA (SP–DRFA) and double–pass DRFA (DP–DRFA). The bi-directional fiber model is adopted in this work as a Raman gain medium at different lengths utilizing different pumping scheme directions. A comparison between the SP–DRFA and the DP–DRFA was also done at the optimum pump power (OPP) condition. The performance parameters of these amplifiers are analyzed and discussed in term of the average gain level ($G_{av.}$), amplification bandwidth within 3–dB variation (GBW), the Stimulated Brillouin Scattering (SBS) effect and the average noise figure ($NF_{av.}$). For the gain medium length of 7 km, a flat GBW of 30 nm is obtained within a small input signal power (P_{in}) of –30 dBm by utilizing SP–DRFA design with backward and forward pumping schemes at OPP of 600 mW and 700 mW, respectively. While, for DP–DRFA design the OPP was 300 mW and 350 mW for the backward and forward pumping schemes, respectively, with flat GBW of 29 nm. The G_{av} for the DP–DRFA was improved by 16.5% and 22.9% at the counter and co–pumped schemes, respectively, as compared to the SP–DRFA. The pump power for the DP–DRFA was also conserved by 51.22% and 60.6% for co– and counter–pumped, respectively, as compared to the SP–DRFA.