Rancang bangun sistem penguatan optik Erbium Doped Fiber Amplifier (EDFA) pada rentang panjang gelombang L Band

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Abstrak

ABSTRAK
Erbium doped fiber amplifier (EDFA) menjadi kunci utama komponen
dense wavelength division multiplexing (DWDM) dalam sistem komunikasi fiber optik.

EDFA L band relatif bekerja pada inversi populasi rendah dimana energi
absorpsi dan emisi bekerja pada level energi konvensional dengan menghasilkan penguatan positip. Pola daya laser diode pumping (LDP) menjadi bagian terpenting dalam pengaturan EDFA L band, khususnya untuk menentukan penguatan tinggi dengan noise yang rendah. Dalam penelitian ini dikembangkan sebuah rangkaian elektronika menggunakan komponen high end technology dengan stabilitas dan akurasi tinggi dengan fitur: laser diode pumping (LDP), termo electric cooler (TEC) dan power meter diatas sebuah rangkaian kompak
printed circuit board (PCB) terintegrasi.

EDFA diatur pada forward pumping dengan satu buah LDP 980 nm.
Panjang EDFA yang digunakan berukuran 13.5 meter, nilai ini dipilih untuk mengefisienkan daya LDP agar didapat daya keluaran penguatan yang maksimum terhadap daya sinyal masukan minimum. Prototipe dikarakterisasi kemudian diverifikasi menggunakan analisa numerik Matlab untuk menentukan performa sistem penguatan optik EDFA secara keseluruhan.

Parameter unjuk kerja seperti gain dan noise figure (NF) dapat diperoleh dengan mengubah daya laser pompa berturut-turut 53.6 mW, 61.1 mW, 64.83 mW dan 68.25 mW dengan sinyal masukan berturut-turut -20 dBm, -15 dBm, -10 dBm dan -5 dBm. Hasil eksperimen menunjukan bahwa sinyal masukan terkecil -20 dBm dapat dikuatkan hingga diatas 3 dB dengan noise figure (NF) rata-rata dibawah 4 dB.
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ABSTRACT
Erbium doped fiber amplifiers (EDFA) have become major key components for dense wavelength division multiplexing (DWDM) optical fiber communication systems.

An L-band EDFA operates in a relatively low population inversion that a
positive net gain is produced for L-band signals while energy absorption occurs at the conventional band. Therefore, pumping scheme has become major issues in L band EDFA to obtain high gain and low noise figure (NF) as well as pump power efficiency. In this research we have developed a high stability and accuracy circuit
using high end technology components, the feature such as: laser diode pumping, thermo electric cooler and

power meter on a compact printed circuit board (PCB).

EDFA was regulated at forward pumping using simple single pump
structure with 980 nm pump laser and short L band EDFA. Length of EDFA is 13.5 meters were used, the purpose is to get short L band length but with efficient pumping power to get good gain output at several pumping and signal power. Prototype has characterized and verified using numerical analysis Matlab to determine performance of EDFA system overall.

The performance parameter such as gain, NF and output power was taken at
L band ITU wavelength standard with four different laser diode pumping powers of 53.6 mW, 61.1 mW, 64.83 mW and 68.25 mW respectively. A range of different input signal power ranging was used of -20 dBm, -15dBm, -10 dBm and -5 dBm respectively. Experimentally, the lowest power at -20 dBm can be amplified up to 3 dB within lowest noise figure bellow 4 dB.