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Modeling Erbium-Doped Fiber Amplifiers

ABSTRACT - Masterthesis

Erbium-Doped Fiber Amplifiers are significantly important components in long-haul fiber networks, which are enabling high-speed connections all over the globe. In this thesis work, after discussing fundamental principles and characteristics of an EDFA, we focus on modeling EDFA operating in C-band and L-band by using a simulation tool named GainMaster^{TM}. A basic EDFA in C-band is modeled to understand the characteristics and behaviors of gain, noise figure and ASE of a typical EDFA. An L-band EDFA is investigated afterward with the emphasis an configuration design. Based on the comparison of three designs (copropagating, counterpropagating and bidirectional pump design), a bidirectional pump design that provides more efficiency is chosen to do further simulation. A 28 m of erbium-doped fiber length is picked as an optimum length for the simulation setup and for the experimental setup in laboratory. The measurement in experiment indicates an ineffective performance of the EDFA with very low gain (below 0 dB at several signal wavelengths). Based an the assumption that the pump powers are too low for 28 m of fiber length due to high splice loss, the fiber is reduced to 20 m. The new results from measurement prove that the EDFA with length of 20 m performs more efficiently when providing maximum gain at 31 dB. Conclusions are then discussed.