

Abstract

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Pump depletion impact in fiber Raman amplifier

In this paper, forward stimulated Raman scattering (SRS) is theoretically discussed and investigated in a distributed Raman fiber amplifier (DRFA). This is carried out with consideration of the pump depletion due to the SRS process. The effect of pump depletion on the performance of Raman amplifiers is clarified. It appears above threshold values of pump power of 330 mW, and fiber length of 135 km, respectively. Analytical expressions are derived for threshold depletion length and threshold depletion pump power in forward pumped Raman amplifier. In the backward pumped amplifier, an expression for the safe fiber length is derived such that the signal power can be amplified without losing its characteristics. Analytical expressions are also derived for the unity gain amplifier length in both forward and backward pumped amplifiers and for the maximum transmission length without a repeater for bidirectional pump amplifiers. The maximum unrepeated transmission length in this case was found to be about 472 km at signal power of 0.1 W and pump power of 0.5 W.