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Title:Optimization of fiber Raman amplifier in a gain saturation regime

Authors:Bindal, A. (1); Singh, S. (2)

Author affiliation:(1) Dept. of ECE, K.C. Gov. Polytech. for Women, Ambala, India; (2) Dept. of

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Abstract:We investigated Raman gain spectrum and its dependence on Stoke's shift for fiber Raman amplifiers (FRAs). We determined that the Raman gain spectrum is fairly broad with a gain variation of less than 1 dB from the pump wavelength of 1440 to 1460 nm with maximum gain at 1451.2 nm, which corresponds to a Stoke's shift of 13.4 THz for the input signal source at 1550 nm. Also, the effect of both a co-propagating and counter-propagating scheme on FRAs was studied without using any booster before the Raman fiber, and it was determined that a small signal gain in the case of the counter-propagating scheme is much higher than that of the co-propagating scheme. The impact of the Raman constant (f<sub>r</sub>) on gain saturation is also illustrated. We have demonstrated that at high f<sub>r</sub> (&gt;0.18), gain saturation conditions worsen. This suggests that higher saturation input powers can be achieved by selecting an f<sub>r</sub> value of 0.18 for small-signal gains of 20 dB and an input power of -20 dBm. We have numerically simulated the gain of a FRA for different Raman fiber lengths using varying pump powers. Gain saturation was observed when the input powers exceeded 5 dBm in an amplifier with a small signal gain of 20 dB, pump power of 1.2 W, and Raman fiber length of 8 km.

Number of references:14

Inspec controlled terms:light propagation - optical fibre amplifiers - optical pumping - optimisation

Uncontrolled terms:fiber Raman amplifier - gain saturation regime - optimization - Raman gain spectrum - Stoke shift - pump wavelength - co-propagating scheme - counter-propagating scheme - Raman constant - Raman fiber lengths - wavelength 1440 nm to 1460 nm - wavelength 1550 nm - frequency 13.4 THz - power 1.2 W - distance 8 km

Inspec classification codes:A4255N Fibre lasers and amplifiers - A4260B Design of specific laser systems - B4320F Fibre lasers and amplifiers

Numerical data indexing:wavelength 1.44E-06 1.46E-06 m;wavelength 1.55E-06 m;frequency

1.34E+13 Hz;power 1.2E+00 W;distance 8.0E+03 m
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Discipline:Physics (A); Electrical/Electronic engineering (B)
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