Examples

Two-stage EDFA with Midstage GEF

Description

Key performance characteristics of EDFAs such as high gain, low noise figure, high output power and gain flatness can be achieved in two-stage (or three-stage) amplifiers. The two-stage design provides capabilities to suppress ASE noise by the midstage optical isolator and ASE filter, which reduces amplifier saturation and positively contributes to the gain, power and noise characteristics. In such devices, the first stage can be viewed as a low-noise preamplifier, and the second stage as a power amplifier. High gain flatness of the amplifier is achieved by using a midstage Gain Equalization Filter (GEF).

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Typical Results

The simulation setup is displayed in Figure 1. 40 WDM channels in the C-band with 100 GHz spacing and power level of -20 dBm (assuming attenuation in the previous transmission fiber) are launched into the first EDF section via an ideal wavelength-selective coupler. The forward pumping of the first section with 80-mW power at 980 nm ensures a high inversion ratio and a low noise figure along the fiber length, especially in the vicinity of the front fiber end where the signal power is minimum. The second stage is pumped by 200 mW at 1480 nm to provide a better conversion efficiency. This setup demonstrates the optimization of the midstage GEF to achieve a uniform channel power distribution. Since the required GEF profile depends on the gain spectrum of the EDFA (which in turn is affected by the GEF), an iterative optimization is applied. The algorithm is implemented in the hierarchical design represented in Figure 2. The optimization goal is defined in terms of the maximum acceptable difference of the channel powers, which was set here to 0.1 dB. The GEF profile and the output EDFA spectrum are shown for different iterations in Figure 3 and Figure 4 respectively.

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Further Information

Keywords: EDFA, Two-stage EDFA, Forward pump, Backward pump, C-band, Gain Equalization Filter (GEF), Optimization

Similar demonstrations are available in VPIcomponentMaker Fiber Optics and on the VPIphotonics Forum.

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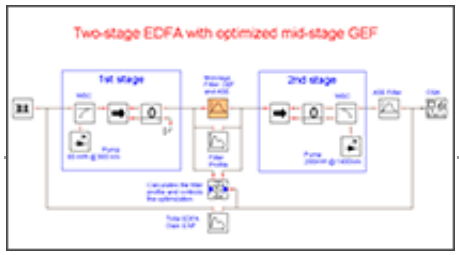

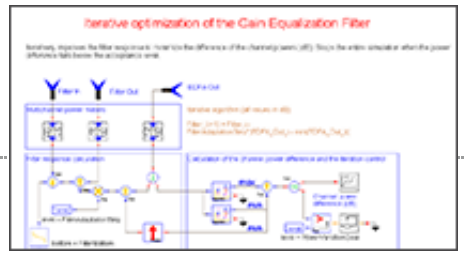

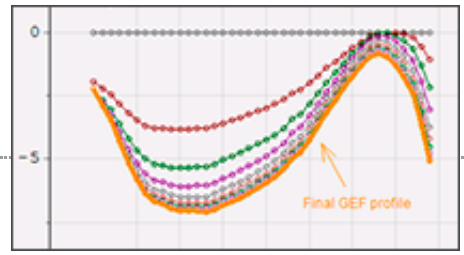

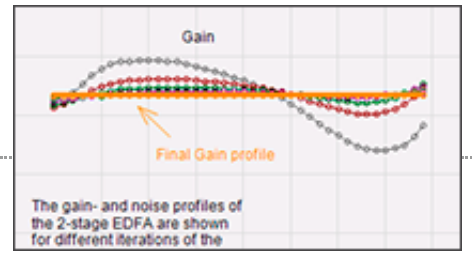

» » Figure 2 » F » Figure 4

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