Saturation properties of four-wave mixing between short optical pulses in semiconductor optical amplifiers

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directional MSSI swapping at 10 and 20 Gbit/s are shown in Fig. 3. The coupled CW pump power in the experiment was 6 to 7 dBm. The coupled signal power was around ~6 to ~7 dBm. The difference in CW pump power for equal FWM output power for up- and down-conversion was 2–3 dB. These values are in good agreement with the model predictions.

In conclusion, large signal simulations of a novel scheme of bi-directional FWM are shown to be in good agreement with experiments and identify critical aspects of the system performance. Recently, an integrated DFB/SOA laser has been shown to operate as an MSSI dispersion compensator via NDFWM with a 10 GHz pulse train and 2.5 Gb/s data. Although the former does show some degradation, it is believed that further optimization of the device (such as reduced FWM bandwidth) will lead to far superior performance. A full bit error rate analysis and results at 10 Gb/s will be presented at the conference.


CTuW5 5:30 pm

Saturation properties of four-wave mixing between short optical pulses in semiconductor optical amplifiers

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Four-wave mixing (FWM) between short optical pulses in a semiconductor optical amplifier (SOA) is of considerable interest for performing high-speed optical de-multiplexing or optical sampling. The large gain of the SOA makes efficient FWM over detunings of several nanometers possible. Since FWM relies on physical processes like carrier density modulation and ultrafast intraband carrier dynamics.
very effective approach that avoids the solu-
tive effects seen in the experiment. We at-
bitrate and pulsewidth.

due to carrier heating and spectral holeburn-
ing) that all contribute to gain saturation and therefore counteract the FWM process, the background ratio (SBR) are measured using an ping, into a 980 pm long bulk InGaAsP ampli-
fers. The efficiency (conjugate power at output

due to saturation of the gain coefficients them-
sew themselves, which is not included in the model.

The existence of a certain gain, or injection

time (ms) for dropping 8, 20, or 60 channels

Figure 1 shows the experimental set-up. Pump and probe pulses are generated using two synchronized external cavity semiconduc-
tor modelocked lasers, which can be tuned in pulswidth and repetition rate. The pulses are injected, co-polarized and temporally overlapping into a 990 pm long bulk InGaAsP ampli-
fers. The efficiency (conjugate power at output
divided by probe input) and the signal-to-
background ratio (SBR) are measured using an optical spectrum analyzer (1 nm resolution 

Figure 2 depicts calculated results using the known parameter values from the experiment. The theoretical model incorpor-
ates a detailed treatment of propagation effects as well as ultrafast carrier dynamics, but the application of a simple mathematical trick transforms it into a tractable and numerically very effective approach that avoids the solu-
tion of partial differential equations.5

The calculated results capture all the qual-
tative effects seen in the experiment. We at-
tribute the quantitative differences between experiment and theory to uncertainties in the parameter values as well as dynamical effects 

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