PHASE AND INTENSITY CHARACTERISATION OF TRANSMITTED PULSES

M.A.F. Roelens[1], M. Forzati[2], P. Petropoulos[1], A. Berntson[2], A. Djupsjöbacka[2] and D.J. Richardson[1]

[1] Optoelectr. Res. Centre, University of Southampton, SO17 1BJ, Southampton, U.K.
[2] Optical Systems and Networks Laboratory, Acreo AB, S-16440 Kista, Sweden
E-mail: michael.roelens@ieee.org

The emergence of more bandwidth efficient modulation formats in high speed optical communications calls for more sophisticated measurement and characterisation techniques than conventional intensity measurements. We have investigated the use of linear spectrograms to assess the phase and intensity profiles of 40 Gbit/s alternating phase return-to-zero pulses (Fig. 1(A)), before and after propagation in an installed fibre link.
From spectrograms, constructed by spectrally resolving the gated pulse as a function of the delay between the pulse and the gate [1], the complete intensity and phase of the pulse can be retrieved [2]. The gate function is implemented by an electro-absorption modulator which is driven synchronously to the pulses under test by means of a photo-diode and a clock extractor, as shown in Fig. 1(B).
The data signal was transmitted over a fibre link running from Stockholm to Gävle and back. The link is 540 km long, and includes amplifiers, dispersion compensating fibre modules and tuneable dispersion compensators. The results retrieved from the spectrogram method are in excellent agreement with optical sampling oscilloscope intensity measurements, but also provide the important phase information. Fig. 2 shows results of pulses measured before and after propagation over the link. This information can then be used to optimise and tune devices in the link, such as a tuneable dispersion compensator.

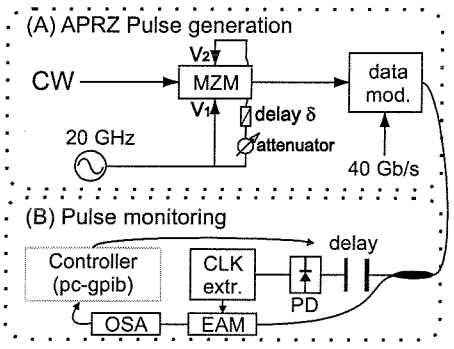

Fig. 1. Experimental setup.

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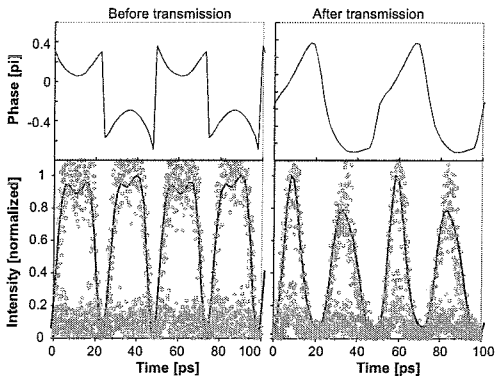

Fig. 2. Retrieved phase and intensity (full lines), and measured eye diagrams.

[1] C. Dorrer and I. Kang, "Simultaneous temporal characterization of telecommunication optical pulses and modulators by use of spectrograms," Optics Letters **27**, 1315–17 (2002).

[2] D. Kane, "Recent progress toward real-time measurement of ultrashort laser pulses," IEEE Journal of Quantum Electronics **35**, 421–31 (1999).