implemented by replacing the rotatable polarizer in Fig. 1 by a polarizing beam splitter, which, when properly aligned with respect to the PMF, would provide two outputs equivalent to the outputs of a conventional MZ interferometer. The temporal difference between the two outputs, measured by means of a balanced photodetector, is proportional to the input intensity and to the frequency chirp. The reduction of jitter and noise achieved with the balanced detection would allow for real-time and single shot TRC measurements. Furthermore, this balanced set-up could be used as demodulator of phase modulated optical signals to recover the instantaneous phase profile, in a similar manner to the balanced PROUD set-up based on a MZ interferometer [25].

4. Conclusions

We report the implementation of a simple, fiber based set-up for the direct measurement of the TRC in telecommunication optical signals. The instantaneous frequency is recovered from the temporal intensity of the pulse after temporal differentiation with a fiber based polarization interferometer, which is implemented with a PMF patch-cord and two linear polarizers. Our set-up avoids the temporal delay compensation needed in previously reported implementations of PROUD simplifying the experimental apparatus.

As a proof-of-concept the technique has been applied to characterize the TRC of a GS DFB laser emitting at 1540 nm. Single peaked and multi peaked pulses with durations ranging from 100 ps to 880 ps were measured. This is the first time, as far as we know, that phase recovery by optical differentiation is applied to the characterization of the carrier induced frequency modulation occurring during the relaxation oscillations in a directly modulated semiconductor laser. The spectra calculated from the measured intensity and the recovered phase were compared with the measured spectra, indicating that the error in the TRC is lower than 10%.

In comparison with other techniques for the complete characterization of optical signals our implementation has clear advantages regarding simplicity and accuracy. Moreover, it can be further improved for single shot real time characterization of phase modulated signals.

Acknowledgments

The authors would like to thank José Azaña and Yongwoo Park (INRS-EMT, Quebec) for their continuous and encouraging support, their suggestions for the implementation of the polarization interferometer, and helpful discussions. This work was supported by the Ministerio de Ciencia e Innovacion of Spain under project TEC2009-14581.

#144483 - $15.00USD Received 18 Mar 2011; revised 30 Apr 2011; accepted 12 May 2011; published 18 May 2011