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Optical Spectral Reshaping for Directly Modulated 4-Pulse Amplitude Modulation Signals

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ABSTRACT

The tremendous traffic growth in intra/inter-datacenters requires low-cost high-speed integrated solutions [1]. To enable a significantly reduced footprint directly modulated lasers (DMLs) have been proposed instead of large external modulators. However, it is challenging to use DMLs due to their low dispersion tolerance and limited achievable extinction ratio (ER). A promising solution to this problem is optical spectral reshaping (OSR) since it is possible to increase the dispersion tolerance as well as to enhance the achievable ER for both on-of-keying [2] and 4-pulse amplitude modulation (PAM) [3] signals. However, moving to 4-PAM,many of the impressive demonstrations reported so far rely heavily on off-line digital signal processing (DSP), which increases latency, power consumption and cost. In this talk, we report on (i) a detailed numerical analysis on the complex transfer function of the optical filter for optical spectral reshaping in case of pulse amplitude modulation and(ii) an experimental demonstration of real-time dispersion-uncompensated transmission of 10-GBd and 14-GBd 4-PAM signals up to 10- and 26-km SSMF. This is achieved by combining a commercial 10-Gb/s DML with optical spectral shaping, thus removing the need for any complex off-line DSP and improving dispersion tolerance. These achievements are enabled by OSR based on a passive microring resonator fabricated on the SOI platform [4]. Significant improvement in receiver sensitivities was observed for both a 10-GBd signal after 10-km SSMF transmission and 14-GBd with no penalty after 26-km SSMF transmission.

REFERENCES

[1] O. Ozolins *et al*.: 100 GHz externally modulated laser for optical interconnects [Invited paper], *J. Lightwave Technol*., preprint, 2017.

[2] V. Cristofori *et al*.: Direct modulation of a hybrid III-V/Si DFB laser with MRR filtering for 22.5-Gb/s error-free dispersion-uncompensated transmission over 2.5-km SSMF, in *Proc. ECOC*, Düsseldorf, 2016, paper Th.2.P2.SC4.42.

[3] C. Yang *et al*.: IM/DD-based 112-Gb/s/lambda PAM-4 transmission using 18-Gbps DML, *IEEE Photon. J*., vol. 8, pp. 1-7, 2016.

[4] F. Da Ros *et al*.: 4-PAM dispersion-uncompensated transmission with micro-ring resonator enhanced 1.55-μm DML, in *Proc. CLEO*, California, USA, 2017, submitted.