Information Rates in EDFA and Raman Amplified Optical Communication Systems Using Nonlinearity Compensation

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ABSTRACT

Optical networks form an integral part of the world-wide communication infrastructure and nowadays over 95% of data traffic is carried over fibres. Erbium-doped fibre amplifiers (EDFAs) and Raman amplifiers have made it possible to extend the usable fibre bandwidth to increase the achievable capacity of optical communications in past decades to meet the ever-growing information rate demands. However, these amplification technologies are now viewed as limiting the accessible optical spectrum to ~5 THz and ~10-15 THz, respectively. Currently, the presence of Kerr effects in fibre channels has been largely regarded as the major bottleneck for enhancing achievable information rates of optical communications. Signal performance degradations due to fibre nonlinearities are more severe in the systems utilising larger transmission bandwidths, closer channel spacing and higher-order modulation formats. In this work, we will investigate the behaviour and compensation of Kerr effects to analyse the performance of optical fibre communication systems using EDFAs and Raman amplifiers. Information rates of such ultra-wideband optical transmission systems will be discussed considering the nonlinearity compensation and transceiver limitations.

References

[1] D. Semrau et al., "Achievable information rates estimates in optically amplified transmission systems using nonlinearity compensation and probabilistic shaping," Optics Letters, Vol.41(21), 121-124, 2017.

[2] T. Xu et al., "Modulation format dependence of digital nonlinearity compensation performance in optical fibre communication systems," Optics Express, Vol.25(4), 3311-3326, 2017.

[3] G. Liga et al., "On the performance of multichannel digital backpropagation in high-capacity long-haul optical transmission," Optics Express, Vol.22(24), 30053-30062, 2014.

[4] T. Xu et al., "Equalization enhanced phase noise in Nyquist-spaced superchannel transmission systems using multi-channel digital back-propagation," Scientific Reports, Vol.5, 13990, 2015.