**Optics Communications**
Volume 472, 1 October 2020, 125864

# Efficiency enhancement of phase-conjugated twin waves technique by shaping envelopes of subcarriers in all-optical OFDM systems

Shahad S.Husain[a] Jassim K.Hmood[a] Sulaiman W.Harun[b]

## Abstract

All-optical orthogonal frequency division multiplexing (AO-OFDM) transmission, which employs high-order modulation formats, opens up a new field of advanced optical transmission. However, a major limitation is the impact of Kerr nonlinearity on AO-OFDM systems that induces nonlinear phase noise (NPN). In this work, we proposed a new method for suppressing NPN in AO-OFDM systems based on shaping envelopes of phase-conjugated twin waves (PCTWs). In the proposed method, each subcarrier and its phase-conjugated replica are firstly modulated with m-array quadrature amplitude modulation (mQAM) format and then shaped by return-to-zero (RZ) coding format. Sequentially, the subcarriers are multiplexed to form twin AO-OFDM signals, which are sent into two similar fiber links. At receiver, both waveforms are separately detected and twin subcarriers are coherently added for suppressing the NPN. An analytical model that characterizes NPN in proposed system is also developed. In addition, the performance of proposed system with 15 subcarriers that modulated by a RZ-4QAM format is numerically demonstrated. The results show that the NPN is considerably suppressed and system performance is highly improved. A signal-to-noise ratio (SNR) is enhanced by 5.7 dB and transmission length is lengthened by 150% as compared to conventional 4QAM-AO-OFDM system.