**Wavelet Packet Transform (WPT) Applications in High Spectral Efficiency (SE) Optical Communication Systems**

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### Abstract (300 word limit)

There exist two approaches to the signal processing in the optical communication systems: the electric domain signal processing and the optical signal processing [1], [2]. In the latter case, the fast nonlinear optical phenomena such as self-phase modulation (SPM), cross-phase modulation (XPM), four-wave mixing (FWM) are used for the digital, analogue and quantum information processing [2]. The passive photonic components such as Mach-Zehnder interferometers (MZIs) and ring resonators can also be used as basic elements for the all-optical signal processing [1]. The optical signal processing increases the processing speed and reduces the energy consumption and latency of the optical communication systems [2]. Such operations as all-optical wavelength conversion (WC), radio and microwave frequency pulse generation and beam forming, orthogonal frequency-division multiplexing (OFDM), switching, regeneration, can be realized [1]-[3]. Coherent optical OFDM (CO-OFDM) systems combine the advantages of coherent detection and OFDM modulation [4], [5]. However, the performance of CO-OFDM systems strongly deteriorates due to the inter-symbol-interference (ISI) and inter-carrier-interference caused by the channel chromatic dispersion and polarization dispersion (PMD) [4], [5]. The different types of the wavelet packet transform analysis such as a wavelet packet transform (WPT), multi-wavelet and complex wavelet analysis for the CO-OFDM systems had been proposed instead of discrete Fourier Transform (DFT) and inverse DFT (IDFT) [6]-[8]. In such a case, the signal is expanded in an orthogonal set of wavelet packets (WPs) as the basis functions, where each channel occupies a separate WP [6].

We investigated numerically the advanced modulation formats QAM 16, QAM 4 for the 1Tb/s transmission in the long-haul WPT-OFDM systems. The comparison of these system performance with the conventional OFDM systems shows that the WPT-OFDM systems have some advantages.

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**Recent Publications**

**([1].Y. Ben Ezra, A. Zadok, R. Califa, D. Munk, B.I. Lembrikov, All-Optical Wavelet Based Orthogonal Frequency Division Multiplexing (OFDM) System Based on Silicon Photonic Integrated Components, IET Optoelectronics, vol. 10, issue 2, pp. 44-50, 2016.**

**[2] Y. Ben Ezra, B.I. Lembrikov, Ultra-fast all-optical memory based on quantum dot semiconductor optical amplifiers (QD-SOA). In: Optical Fiber and Wireless Communications, Ed. Rastislav Roka, InTech, Croatia, 2017, pp. 279-293.**

**[3] Y. Ben Ezra, B.I. Lembrikov, Improvement of the quantum dot-in-a-well (QDWELL) laser and amplifier performance under the optical injection. In: Optical Communication Technology, Ed. Pedro Pinho, InTech, Croatia, 2017, pp.74-99.**

**[4] Y. Ben Ezra, B.I. Lembrikov, Quantum dot semiconductor optical amplifiers (QD-SOA): dynamics and applications. In: Optical Amplifiers. A Few Different Dimensions. Ed. P.K. Choudhury, InTech, London, UK, 2018, pp. 10-38.)**



**Prof. Yosef Ben Ezra**, Dean of Engineering faculty at Holon institute of Technology and CTO at Mer Group, received his Ph.D. from the Tel-Aviv University. During 2003-2005 Prof. Ben-Ezra was the principle researcher in joint industry-academy project TRANSMOR focused on automatic detection and classification of power transients in WDM optical communication networks. Between 2007-2009 Prof. Yosef Ben-Ezra was the principle researcher in a joint industry-academy project, DIAMOND, that developed high-spectral-efficient modulation techniques for modern optical communications. In the framework of MAGNET project Tera-Santa Prof. Ben-Ezra develop the novel method of OFDM based on Multiwavelets. He is currently working on the silicon photonic implementation of the Multiwavelet OFDM in Peta-Cloud consortium. He has co-authored over 85 papers in international journals and conferences in fields of semiconductor physics and nonlinear effects, and optical communication. He is the author 15 chapters in scientific books and of 12 patents.

Biography (150 word limit)

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