

All-Optical Ultra-High-Speed OFDM to Nyquist-WDM Conversion Based on Complete Optical Fourier Transformation - DTU Orbit (08/11/2017)

All-Optical Ultra-High-Speed OFDM to Nyquist-WDM Conversion Based on Complete Optical Fourier Transformation

We propose a novel all-optical ultra-high-speed orthogonal frequency-division multiplexing (OFDM) to Nyquist wavelength-division multiplexing (Nyquist-WDM) conversion scheme, achieved by exchanging the temporal and spectral profiles using a complete optical Fourier transformation (OFT). This scheme enables high-speed OFDM to Nyquist-WDM conversion without complex optical/electrical/optical conversion. The all-optical OFDM transmitter is based on the generation of OFDM symbols with a low duty cycle by rectangular temporal gating, which in combination with optical time-division multiplexing yields a higher symbol-rate OFDM signal. In the receiver, the converted Nyquist-WDM super-channel is WDM demultiplexed into individual Nyquist-WDM channels using a rectangular optical bandpass filter, followed by optical sampling at the intersymbol-interference free point. In the experimental demonstration, a single-polarization 8-subcarrier 640 Gb/s differential phase-shift keying OFDM super-channel with a spectral efficiency (SE) of 0.8 symbol/s/Hz is generated. The OFDM super-channel is then converted to eight 80-Gb/s Nyquist-WDM channels by complete OFT. The complete OFT is based on two quadratic phase-modulation stages using four-wave mixing, separated by a dispersive medium. In the receiver, a BER $<10^{-9}$ is obtained for all channels. The SE remains unchanged after conversion.

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