BER performance for PSK-OFDM optical link over Exponentiated Weibull atmospheric turbulence

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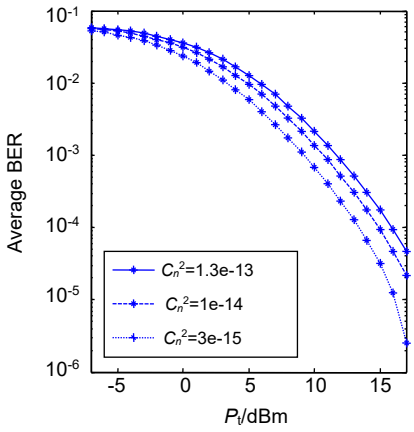

Average BER versus the transmitted power P_t for the different turbulence strengths when L is 50 km, M is 4, the normalized jitter σ_s/r is 0.5 and the normalized beam width w_z/r is 1.

Overview: Laser communication has many advantages, such as large bandwidth, high speed, fast and simple deployment and free band. Compared with traditional radio communication, it has a wider application prospect in civilian and military applications. However, in aviation laser communication, aircraft flight at an altitude of 7 km~10 km, airborne laser link is extremely easy to be influenced by the atmospheric turbulence intensity fluctuation in the receiving end, at the same time, the atmospheric boundary layer around the plane generated by the aero optical effects on the laser signal transmission will be affected. Orthogonal frequency division multiplexing (OFDM) is a multi carrier modulation mode, which modulates multiple independent data streams through multiple subcarriers with different frequencies. It has good anti frequency selective fading, narrow band interference and high channel utilization. OFDM subcarrier can use many different modulation modes. The two main modulation modes are multilevel quadrature amplitude modulation (MQAM) and multiple phase-shift keying modulation (MPSK). The quadrature amplitude modulation (QAM) demodulator needs to detect the phase and amplitude at the same time, and phase shift keying (PSK) demodulation only needs to detect the phase. In 2012, Barrios R and Dios F first proposed the Exponentiated Weibull atmospheric turbulence model for the weak to strong turbulence and the average aperture. Therefore, aiming at the characteristics of Aeronautical laser communication, based on the Exponentiated Weibull distribution atmospheric turbulence model, the joint pointing error is used to study the performance of OFDM system with PSK modulation mode. Aiming at the combined effects of the Exponentiated Weibull atmosphere turbulence, aero-optical effects and pointing errors on space optical links, the bit error rate (BER) performance of the OFDM optical communication link is investigated. OFDM links adopted PSK modulation. The closed-form expression for average bit error rate is derived based on a Meijer's G function. The relationship between the BER performance and the transmitted optical power under different parameters such as the atmosphere turbulence, the normalized jitter standard deviation and the normalized beam-width is analyzed by simulation. The results show that the BER performance is similarly improved in different intensity turbulence by increasing the transmitted optical power. The BER performance is obviously improved by increasing the transmitted optical power when the normalized jitter standard deviation is less than 0.7 and the modulation order is less than 4. In practical application, the derived average error rate closed expression can be used to estimate the performance of the system and provide reference for the design of the aviation laser communication system.

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