Abstract

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Performance Evaluation of Free Space Optical Communications

Free Space Optical (FSO) communication has received a great interest in recent years as a solution of some challenges facing fiber optic communications and wireless communications. Transmitters and receivers design, investigating pointing errors, effect of environmental phenomena, link budget, availability and bit error rate (BER) are some of the important research points required to investigate, analyze and evaluate the performance of an FSO link. In this thesis, FSO proposed system performance analysis and evaluation is presented. A link budget mathematical model is presented including transmitter and receiver geometrical gain, optics efficiencies, free space path loss, pointing error loss factors for various wavelengths operation (785 nm, 850 nm and 1550 nm) and modulation line codes (non return to zero (NRZ) and return to zero (RZ)). The system performance is investigated under two weather phenomena (Atmospheric weather conditions and Turbulence) independently and jointly. Also, the effect of thermal noise on the photodetectors (avalanche (APD) photodetector and positive-intrinsic-negative (PIN) photodetector) is considered. The obtained results demonstrated the superior system operation under 1550 nm transmitting wavelength, NRZ line code and APD. Results showed that the effect of fog (independently) on the received signal level, the maximum allowable pointing error and BER is the greatest among other weather phenomena. The fog-weak turbulence jointly has the greatest effect on the signal level, the maximum pointing error and BER compared to the other joint weather phenomena could occur.