

A Comparative Performance Evaluation of Modulation Schemes in FSOC Link Under Severe Atmospheric Conditions

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Abstract : This study evaluates modulation schemes for free-space optical communications systems operating in severe atmospheric conditions. It also proposed a hybrid PPM-PSK modulation scheme and evaluated its performance in simulated environments with heavy weather-induced attenuations and turbulences. The study then compares its robustness and efficiency with other modulation techniques, such as pulse amplitude modulation (PAM), pulse position modulation (PPM), digital pulse interval modulation (DPIM), phase shift keying (PSK), duobinary (DB), and carrier-suppressed return-to-zero (CS-RZ), among others. We then evaluate performance metrics such as bit error rate (BER), channel quality factor (Q-factor), and minimum received power to ascertain the optimality of the suggested hybrid modulation scheme. Results show that the proposed scheme has the optimal performance in terms of the deliverables considered, followed by PSK, PAM, DB, PPM, DPIM, and CS-RZ in the considered adverse case scenarios.

Keywords : atmospheric effects, BER, FSOC, hybrid modulation scheme, Q-factor, received power

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