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Performance Analysis of Double-MIMO Free Space Optical System Under Atmospheric Turbulence

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Abstract. Over the last few years, free space optical communication (FSO) has emerged as a viable alternative to radio frequency communication. It provides a promising high-speed point-to-point communication solution. However, atmospheric absorption, scattering and turbulence degrade wireless optical communication significantly, lowering device efficiency. The attenuation of signals due to the above atmospheric reasons is another major factor that affects device efficiency. The atmospheric turbulence conditions are observed implemented into different models of FSO systems, such as Single Input Single Output (SISO), Multiple Input Multiple Output (MIMO), Wavelength Division Multiplexing MIMO (WDM-MIMO) and proposed model Double Multiple Input Multiple Output (DMIMO) using the Gamma-Gamma model for a variety of reasons. The OptiSystem 7.0 software was used to run simulations to study how various weather conditions (clear, haze and fog) affected the performance of the channel. Simulation results show that implementing Double Multiple Input Multiple Output (DMIMO) techniques for FSO systems provides high quality factor for various ranges while still achieving accurate transmitted data at the receiver side. In the presence of atmospheric turbulence conditions such as clear air, haze and fog, performance improvements signal power levels, quality factor and link distance range have been demonstrated.

Signal Propagation Modeling for Vehicle-To-Infrastructure Communication Under the Influence of Metal Obstruction

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Abstract. Connected car has become one of emerging technology in the automotive industries today. This development preludes a rise in vehicular communication studies that primarily targets radio channel modelling on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication mode. Considering vehicular obstruction, vast channel propagation studies have focused more on V2V mode while others consider the typical urban scenarios consisting of high traffic volumes of moving vehicles. Due to challenging propagation mechanisms and high complexity in such areas, radio propagation models applied in simulators assume an obstacle-free environment rather than considering the least effect imposed by metal obstruction on communication signal. Besides, there are limited studies pertaining to metal obstruction that considers several under-explored environments such as actual parking lots, junctions and other road infrastructure support. As such, this paper demonstrates signal attenuation analysis caused by the presence of metal objects in low density over obstacle-free environment on actual parking lot via V2I mode. Two scenarios such as LOS and NLOS conditions consisting of obstacle-free, cars and buses as static metal objects are evaluated. The aim of this research is to characterize signal strength caused by metal blockage on radio wave propagation predicated on the presence of vehicles as a subject of obstruction in comparison to obstacle-free vehicular environment. The validity of data is shown through received signal strength indicator (RSSI) and approximation analysis (RMSE) to demonstrate the efficiency of obtained measurements. The results demonstrated that Log-normal shadowing model yields the best fit to low-density metal obstruction scenario with smallest RMSE of 4.78 under bus obstruction whereas 5.72 under car obstruction.

Impact of Rain Attenuation in Borneo Using Free Space Optic Propagation

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Abstract. The research is based on assessing different rain intensities through free space optic (FSO) communication transmission. The goal is to see how rain's properties affect the FSO communication system. The Optisys software system is required for this project's simulation. Kuching and Samarahan were chosen as the project's locations. The rain data has been properly gathered from Malaysia Meteorological Department (MMD). The measurement was carried out using a simulation and a real parameter from the Laserbit system. As a consequence of the findings, it will be possible to identify how much rain can obstruct the link and to devise a solution to the problem.