INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Spatial Modulation (SM) and its advanced versions are investigated for various applications in this thesis. Performance analysis of advanced spatial modulation (ASM) are carried out in terms of bit error rate (BER) and outage probability (OP). The ASMs considered are enhanced spatial modulation (ESM), spatial media based modulation (SMBM), optical ESM (OESM), optical generalized spatial modulation (OGSM), optical improved quadrature spatial modulation (OIQSM), transmit laser selection (TLS) combined with optical SM (TLS-OSM), hybrid SM (HSM) and transmit source selection (TSS) combined with HSM (TSS-HSM).

Firstly, SM along with physical layer network coding (PLNC) is proposed for full-duplex wireless radio frequency (RF) communication. Closed form expressions of OP of such systems are provided in this thesis. Cascaded _ − μ channel model is considered for such communication. It is observed that such systems can achieve signal-to-noise ratio (SNR) gain of 8 dB over PLNC scheme.

Secondly, ESM and SMBM are proposed for body area network (BAN) communication especially for sporting activities such as running and cycling. Performance analysis is carried out for both single input-single-output (SISO) system as well as multiple-input-multiple-output (MIMO) system employing the above mentioned ASM schemes in terms of BER and OP. Lognormal-4 (LN-4) channel is considered for BAN communication. It is observed that SMBM outperforms SM and ESM schemes. Another observation is that cycling has better BER and OP than running due to less body shadowing effects.

Thirdly, optical SM (OSM) along with PLNC is proposed for full-duplex free-space optical (FSO) cooperative system. Bounds of OP are calculated for such systems. Further, in order to achieve higher spectral efficiencies in FSO communication, ASM techniques such as OESM, OGSM and OIQSM are proposed. BER, cost and power consumption analysis of the above mentioned ASM techniques are provided in the thesis. Gamma-Gamma (G-G) channel model with pointing error is considered for FSO communication. It is observed that OESM, OGSM, OIQSM and TLS-OSM gives better BER than the conventional OSM.

Fourthly, SISO one-way and two-way relay based underwater optical wireless communication (UOWC) is proposed and performance analysis is carried out in terms of OP. OIQSM and TLS-OSM are proposed for UOWC cooperative communication. Performance analysis of such schemes are carried out in terms of

OP and average symbol error probability (ASEP). Lognormal channel is assumed for UOWC. It is observed that OIQSM and TLS-OSM also outperform OSM for UOWC.

Lastly, HSM and TSS are proposed for hybrid FSO/RF cellular communication. In this cellular system, base station (BS) to access points (APs) are assumed to be connected with FSO links and AP to mobile users are connected using RF links. FSO links are modelled as G-G channel whereas RF links are modelled as Rayleigh fading channel. Performance analysis is carried out in terms of OP. It is observed that TSS-HSM outperforms HSM and TSS based hybrid FSO/RF systems.