A General Framework for Performance Analysis of Space Shift Keying (SSK) Modulation in the Presence of Gaussian Imperfect Estimations

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Spatial Modulation (SM) is a promising multiple-input-multiple-output (MIMO) transmission technique that utilizes the spatial information in a novel fashion. At each time instance, only a single transmit antenna is activated among the set of existing transmit antennas to transmit either a fixed power (no constellation symbol), as in Space Shift Keying (SSK), or a constellation data symbol from the activated transmit antenna, as in conventional SM. As compared to other MIMO techniques, SM is shown to have several advantages, including complete avoidance of inter-channel interference (ICI), relaxed inter-antenna synchronization requirements, low receiver complexity and the use of a single RF chain at the transmitter. Furthermore, with a moderate number of transmit antennas, it has been observed that SM can achieve better error performance than STC (space-time coding) and V-BLAST (Vertical-Bell Lab Layered Space-Time) when perfect channel state information (CSI) is available at the receiver.

The major censure about SM is its performance in real-time transmission and robustness to channel estimation errors due to its working principle. Specifically, some researchers anticipate that the SM system performance will degrade significantly in the presence of imperfect channel knowledge at the receiver due to the mapping of information bits into the index of transmit antennas. This work sheds light on this matter and provides error analysis with the assumption of imperfect channel state information at the receiver side.

Reported results demonstrate some interesting implications on the practical use of SM in the current and future wireless networks. It has been observed that the SM scheme is quite robust to channel estimation errors as compared to STC and VBLAST and requires less training symbols.

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