# Trellis Coded Modulation for Mobile Satellite Communication Systems

Gunawan Wibisono, author

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Abstrak

Trellis coded modulation (TCM) formats with their excellent bandwidth and power efficiency have been widely employed in various communication systems. For mobile satellite communications, trellis coded (TC) M-ary phase shift keying (MPSK) is the primary candidate modulation technique. In the first generation mobile satellite systems, co-channel interference (CCI) does not pose a serious problem. However, second generation systems are expected to reuse frequency to increase the orbit slot spectral efficiency. Then the CCI from adjacent beams and adjacent satellite will be dominant factor determining the system performance and overall capacity. Mobile satellite communication is also suffered from strong variations of the received signal power due to the multipath fading. Typically, mobile satellite channels are modeled as Rician or Nakagami fading; that is the received signal consists of a constant line of sight signal component and a Rayleigh distributed diffuse signal component. Therefore, the performance of system on mobile satellite channels is subject to both fading and CCI.

TCM and antenna diversity are two attractive methods to combat fading and CC1 effects in the mobile satellite communication systems. The research focuses on the using of TCM and antenna diversity to combat the fading and CCI effects on mobile satellite system, and analyze their performance characterized by bit error rate (BER). Because of multipath propagation , the mobile satellite communication channel is modeled as a Rician or Nakagami fading channel. This report, the BER performance of TC asymmetric MPSK with CCI and TC asymmetric MPSK with diversity on mobile satellite communication systems will be investigated and analyzed.

First, the BER performance of TC- asymmetric MPSK in the presence of undesired CCI with multiple interferers and fading channel is investigated. The fading statistic for desired signal is Nakagami fading and the undesired interference signals are Rayleigh fading. We assume that all the interferers are unmodulated because most of errors are produced by Rayleigh fading itself rather than the modulating sequence. This model assumes that all interfering signals have aligned symbol timing and no cross channel interference symbol interfering (ISi) effects. The desired signal is assumed to have Nakagami distribution implying that a dominant multipath exists in transmission. The desired and the interfering carrier have no phase coherence. We derive the BER performance of TC asymmetric MPSK in the presence CCI and fading channels by using the first error event method. It is shown that the BER performance of TC asymmetric MPSK in the presence of CCI is better than that of system with asymmetric MPSK. The BER performance of TC asymmetric MPSK is improved as increasing either the Nakagami fading parameter or the value of signal-to-interference ratio (SIR). As the Nakagami fading parameter is increased the phase signal of MPSK is also increased.

Second, the BER performance of TC MPSK with 2 branch selection combining (SC) and maximal ratio

combining (MRC) diversities on independent and spatially correlated Nakagami fading channel are investigated. The upper bound bounds using the transfer function bounding technique are derived and several numerical results are shown. Is shown that the BER performance of TC 8PSK with MRC diversity is better than that of system with SC diversity. Although the correlation between branches causes the signal-to-noise ratio (SNR) loss (relative to independent fading case) for SC and MRC diversities, the diversity can lead to achieve the diversity gain compared to the system without diversity.

Third, the BER performance of TC 8PSK in the presence of undesired CCI with multiple interferers and fading channel is investigated by using computer simulation. The fading statistic for desired signal is Nakagami fading and the undesired interference signals are characterized by Rayleigh fading. The I3ER performance of TC 8PSK in the presence CC1 and fading channels is simulated by using the first error event method. It is shown from the result that the simulation result of the performance of TC 8PSK in the presence CCI and fading channels is closed to the analytical result.