Maximum Likelihood Block Detection of Noncoherent Multi-h CPFSK

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ABSTRACT

In this thesis, we examine maximum likelihood block detection (MLBD) of noncoherent continuous phase frequency shift keying signals with periodic modulation indexes (Multi-h CPFSK) in AWGN and flat Rayleigh fading channels. First, the maximum likelihood metric is introduced, and the bit error probability of the detection algorithm in an AWGN channel is derived. The noncoherent detector is shown to consist of a bank of matched filters followed by a sequence estimator. In the AWGN channel, the simulation results are consistent with theoretical results, and demodulation using MLBD with a four-symbol observation is compared with MLSD and one-bit differential detection (DD). MLBD has about 3 dB improvements over 1-bit DD, and have no more than 3-4 dB loss than MLSD. The performance of MLBD in a flat Rayleigh fading channel are obtained by computer simulation. When in slowly fading case, it is interesting to note that the performance of a three-symbol observation has 1 dB improvement over a two-symbol observation. However, when fading becomes fast, both the two- and three-symbol observations form an error floor, and the performance of the three-symbol observation is worse than the two-symbol observation at a high SNR. In the flat Rayleigh fading channel, the SNR about 30 dB is required by MLBD to yield a bit error rate of 0.001. Hence, we can conclude that the modulation scheme using the multi-h signal can be a practical one in the fading channel when MLBD is applied.

Keywords : maximum likelihood block detection ; multi-h CPFSK ; bit error rate ; flat Rayleigh fading channel

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