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PAM SELECTION FOR SIMPLIFIED RECEIVERS APPLIED TO BINARY SSB-FSK

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The first connection between linear modulations and continuous phase modulation (CPM) was addressed by Laurent [1]. Laurent showed that any binary non-integer single-h CPM could be presented by a superposition of Pulse Amplitude Modulation (PAM) pulses. Then, Huang et al. provided the PAM decomposition for the particular case of CPM schemes with integer modulation index [2].
In this abstract, we propose to apply the same approach given for the PAM decomposition of CPM signals to single sideband - frequency shift Keying (SSB-FSK) signal with integer/non-integer modulation indices.
Originally, the SSB-FSK signal with information-carrying phase is defined as a classical CPM signal where the frequency pulse is a Lorentzian pulse truncated to a symbol duration L > 1 [3].
The complexity reduction of the Viterbi receiver is directly related to the number of PAM selected to efficiently approximate the original CPM signal for a targeted error probability P_e. Hereafter, we present a flowchart for the associated algorithm used to select the number of PAM pulses. The algorithm depends on two important factors: the PAM pulses obtained from the Mean-Square approximation and the performance bounds of the maximum likelihood detector and the PAM-based receivers.

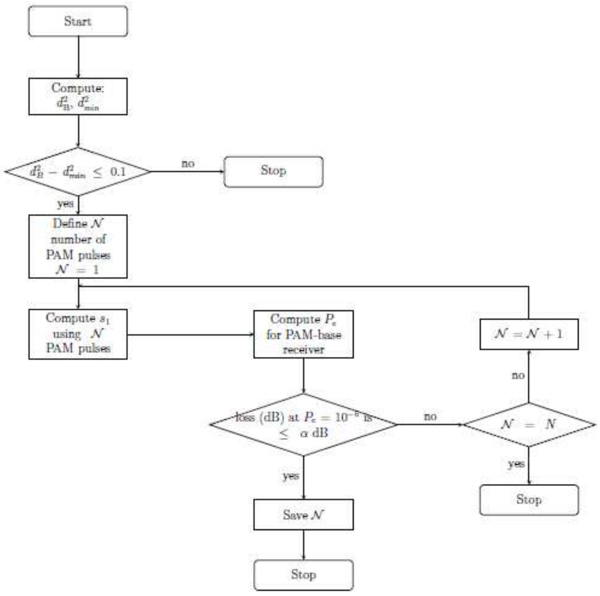

Figure 1. Flowchart of the algorithm to select the number of PAM required for an SNR difference α dB between the optimal MLSD receiver performance bound and the PAM-based receiver performance bound for $P_e = 10^{-5}$.

Using the previous algorithm, we were able to prove that the performance bound for the PAM-based receiver approaches the optimal MLSD performance bound with $\alpha < 0.5$ for the configuration 6SSB-FSK reducing the number of the needed matched filters from 64 to only 8.

References

[1] Pierre Laurent, « Exact and approximate construction of digital phase modulations by superposition of amplitude modulated pulses (AMP) », *IEEE Transactions on Communications* 34.2 (1986), pp. 150–160.

[2] Xiaojing Huang and Yunxin Li, « The PAM decomposition of CPM signals with integer modulation index », *IEEE Transactions on Communications* 51.4 (2003), pp. 543–546.

[3] H. Farès, D. C. Glattli, Y. Louët, J. Palicot, C. Moy, and P. Roulleau, «From quantum physics to digital communication: Single sideband continuous phase modulation », *Comptes Rendus Physique* 19.1 (2018), pp. 54–63, issn: 1631-0705.