New Integer Coded Hexagonal QAM schemes and their performance in AWGN Channel

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❖ Description of the problem

The notion coded modulation refers to any scheme that integrates modulation and error correcting techniques in unified process. Square quadrature amplitude modulation is maybe the most implemented in communication devices modulation scheme. However different types of constellations have been recently subject of research interest. One such constellation with 64 signal points is depicted in Figure 1.It belongs to the family of so called hexagonal quadrature amplitude modulation (HQAM) constellations.

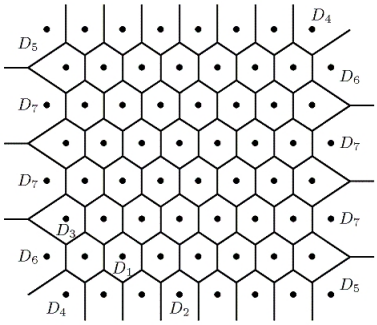

Figure 1: 64-HQAM constellation with detection regions - uncoded case.

During process of communication a signal corresponding to a chosen point from the constellation is sent through the channel. At the receiver detector based on the received signal decides which point is sent. Due to the noise in the channel the decision can be wrong. The classical method for correcting erroneously detected signal points is the use of convolution codes. An alternative approach is the use of integer codes. They enable lower complexity of decoding and can be designed to correct errors of types that are typical (most common) for the chosen channel and constellation.

We (a team of researchers at the Institute of mathematics and informatics) have proposed six coded modulation schemes based on integer codes for HQAM constellations with 16, 32, 64, 128, and 256 points with codes over Z_n.

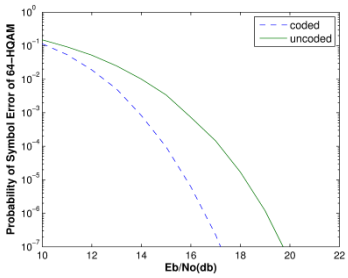

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Figure 2: Probability for error per point for 64-HQAM with code over Z_{65}.

Use of HPC Infrastructure

Theoretical considerations give some bounds on the performance of the proposed coded modulation schemes but they are not sufficient for practical applications. To obtain significant for practice evaluation of the performance large amount of computer simulations of communications using the proposed scheme are necessary. The simulations have to be done for numerous values of signal to noise ratio. The problem was solve thanks to the facilities for parallel computing given by the National Center for High-Performance and Distributed Computing (NCHDC), subject to the National Roadmap for Research Infrastructures (NRRI) [1]

❖ Results and Future Work

Figures 2 and 3 present the performance evaluations obtained by the computer simulations. The developed software is flexible and can be easily modify.

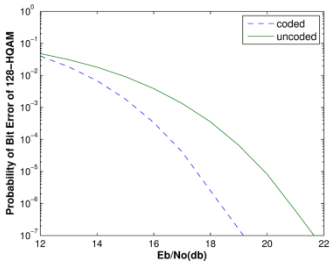

Figure 3: Bit error probability for 128-HQAM with a code over Z_{129}.

1. http://nchdc.acad.bg/