Ovechkin G.V., Ovechkin P.V., Denisova M.A.

APPLICATION OF THE MULTITHRESHOLD DECODER IN TELECOMMUNICATION SYSTEMS WITH M-ary MODULATION

(Russia, Ryazan, the Ryazan state radio engineering academy)

At designing modern systems of telecommunications the maintenance of high reliability of data transfer is one of the major the task. It is necessary to attribute application of error-correcting codes in which development the information theory last decades makes very significant successes to the most effective methods of the decision of the given task. Among existing methods of error-correction coding it is possible to allocate multithreshold decoders (MTD) [1..3] as they are characterized by very small complexity of practical realization both at software, and at hardware implementation. The principle of work of the given method consists in application of several iterations of decoding of information symbols, each of which is small updating of the elementary threshold decoder [4]. MTD possess the major strictly proved property - convergence to the decision of the optimum decoder, keeping linear from length of a code complexity of realization.

In the majority of last publications on the given method results of its research in communication system with binary phase modulation are submitted. In such conditions at comparable efficiency MTD it appears essentially (on two – three order) easier for implementation, than other decoding algorithms [5]. Here we shall consider efficiency MTD in channels with m-ary modulation and we shall carry out its comparison with efficiency of the most effective algorithms of error correcting codes decoding.

On fig. 1 dependence of the bit error rate P_b for the multithreshold decoder from the signal to noise ratio E_b/N_0 in a channel with quadrature amplitude modulation is submitted at 1, 4 and 6 bit/symbol [6]. Thus it was carried out from 10 up to 15 decoding iterations for the block self-orthogonal code (SOC) with code rate R=4/5, code distance d=9 and length L about 16000. The submitted results are received for a case of use of the "soft-decision" modem when the rating of reliability of the symbols accepted from the channel is carried out. On the given schedule for binary phase modulation characteristics of Viterby decoder for a code with length of coding register K=7 both code speed R=4/5 and characteristics of a concatenated code with R~4/5, consisting of a Read-Solomon code and a convolutional code with K=7, decoding with the help of Viterby algorithm also are submitted. Apparently, Viterby decoder and essentially more complex concatenated code concede to the multithreshold decoder at the given code speed. For comparison on the given schedule characteristics of the decoder of a turbo code with a length of interleaver 16000 and code rate R=4/5 are shown. From comparison of efficiency of the turbo codes decoder and the multithreshold decoder it is visible, that last concedes on efficiency of the order 1 dB, however thus complexity of its implementation remains on two and more orders less, that supposes application multithreshold decoders in

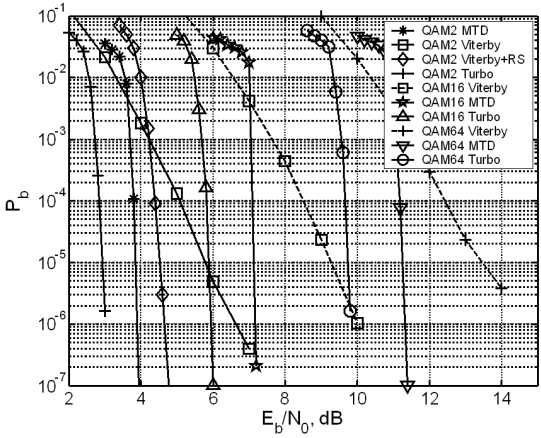

Fig. 1. Performance of MTD over AWGN channel with QAM

high-speed systems of data communication in which significant restrictions on expansion of bandwidth are imposed.

The literature

1. Zolotarev V.V. Multithreshold decoders for systems of communication with extremely small power of a signal // Digital processing of signals, 2004, ¹ 1. pp. 24-28.

2. Zolotarev V.V., Ovechkin G.V. Effective algorithms of error-correcting coding for digital systems of communication // Telecommunication, 2003, ¹ 9. pp. 34-37.

3. Zolotarev V.V., Ovechkin G.V. Error-correcting coding. Methods and algorithms. The directory. M.: "the Hot line – Telecom", 2004. 126 p.

4. Massey J. Threshold decoding. 1963.

5. Zolotarev V.V., Ovechkin G.V. Complexity of effective methods of error-correcting codes decoding // The 6-th International conference and exhibition «Digital processing of signals and its application». M.: 2004. Vol 1. pp. 220-221.

6. Proakis J. Digital communication. 2000.