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CONCATENATED DECODING CIRCUITS FOR DATA BASES AT THE MTD BASIS

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Usage of multithreshold decoders (MTD) for binary codes allows to provide effective enough errors correction. In particular, this algorithm is quite efficient at signal to noise ratio E_b/N_0 <1 dB both in hardware, and in soft variants of decoder realization for code rate R~1/2 [1-6].

Opportunities of non-binary algorithms MTD [1,3-9] are less known, for the first time, probably, described in [10,11] efficiency of MTD algorithms is below considered at processing the symbolical (non-binary) information, coded by majority decoding codes of a new class. In [1,3,6,8] it was marked, that in case of great values of the basis **q**, **q**> 10, it is completely impossible to create effective truly optimum non-binary code decoders, e.g.Viterbi algorithm (VA) as thus their complexity in many cases will look like $\mathbf{q}^{\mathbf{K}}$ where **K** - length of the coding register. Opportunities of decoders for Read – Solomon (RS) codes are very much limited, first of all because of their small length in real systems. So researches and the further development of very simple algorithms such as MTD are represented especially useful.

Non-binary MTD the decoder (further: QMTD) arranged according to [1-4], at each change of decoding symbols passes to more plausible decision in comparison with the previous state of the decoder and can even usually reach for high enough noise level optimum decoder (OD) decisions though it is not optimal decoder. Real MTD can work at such noise level, when all RS codes can't work at all.

Simple circuit QMTD is given in [3]. And QMПД thus keeps linear complexity of realization with length of a code increase.. Concatenation for non-binary circuit increases transmission reliability. It corrects single errors in code blocks which are main form of erroneous blocks at all. It works in the same form as it is done for binary concatenation with MTD using for mod2 second code . For non-binary MTD they use code with the control on mode q. It usually corrects all single symbol errors. All MTD decoder error probabilities are estimated for concatenated schemes.

Results of QMTD modeling with codes of the control on mod q, and also opportunities of usual decoders of codes PC are considered. The volume of modeling in the bottom points of schedules for QMПД made from 5*1010 up to 2*1012 bits, that testifies to extreme simplicity of new effective method. Effectiveness of RS codes is a very low in respect of codes for QMTD.

Demoprogram for QMTD they can take from Internet web-site www.mtdbest.iki.rssi.ru at the page "education". It works quickly enough when channel error probability is more then 0,01 with a speed 5÷25 Mb/s when R=0,95. Instructions form this program is applied also.

Comparison of codes RS and QMTD at code rate R=1/2 has been executed in [5]. We shall note only, that QMПД the decoder for a code of length 32000 appears capable to provide with the elementary majority methods better performance then for code RS with length of 65536 and two-byte symbols.

QMTD are better the new types of a very complex decoders for RS codes also.

Except for natural sphere of simple highly effective methods of coding in communication networks it is necessary to note good opportunities of QMTD application for coding the information on disks and other carriers of great volumes of the information, in the superlarge bases of audio- and video- data with much higher level of reliability, than it was accessible until recently, and also at updating, restoration and use of the stored data. Thus it is easy to provide and the operative constant control over quality of the stored information, and also updating of the data due to defects of the carrier.

Essentially new level of a noise immunity achievable with the QMTD help, allows to solve the listed problems without additional developments of these algorithms or only at their insignificant adaptation to the possible additional requirements arising in similar scaled digital systems.

QMTD opens essentially new opportunities for the symbolical information coding. i. e. the basic kinds of the data practically directly used by a modern information society. Coding provides high controllable quality of the stored(kept), transmitted and formed information. Application of simple and simultaneously highly effective methods of coding can create new high standards of information supply.

The new information about MTD – is at **www.mtdbest.iki.rssi.ru ,** specialized bilingual website SRI RAS**.** Researches were supported by the RFFI with the grant №05-07-90024в.

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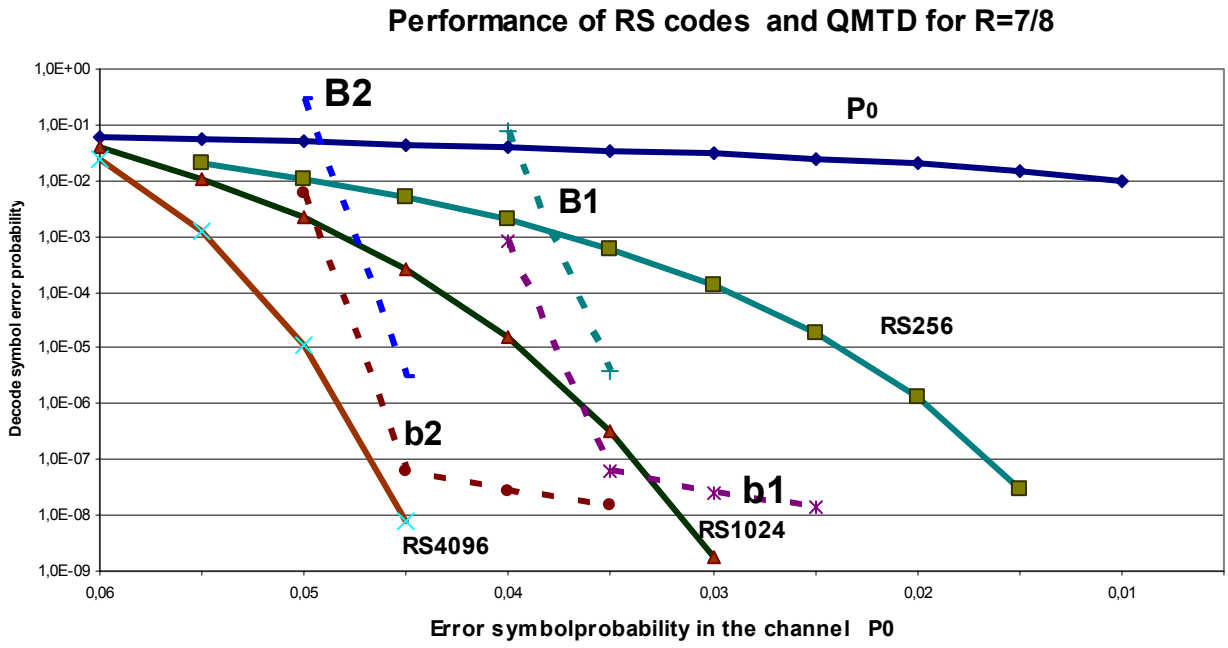
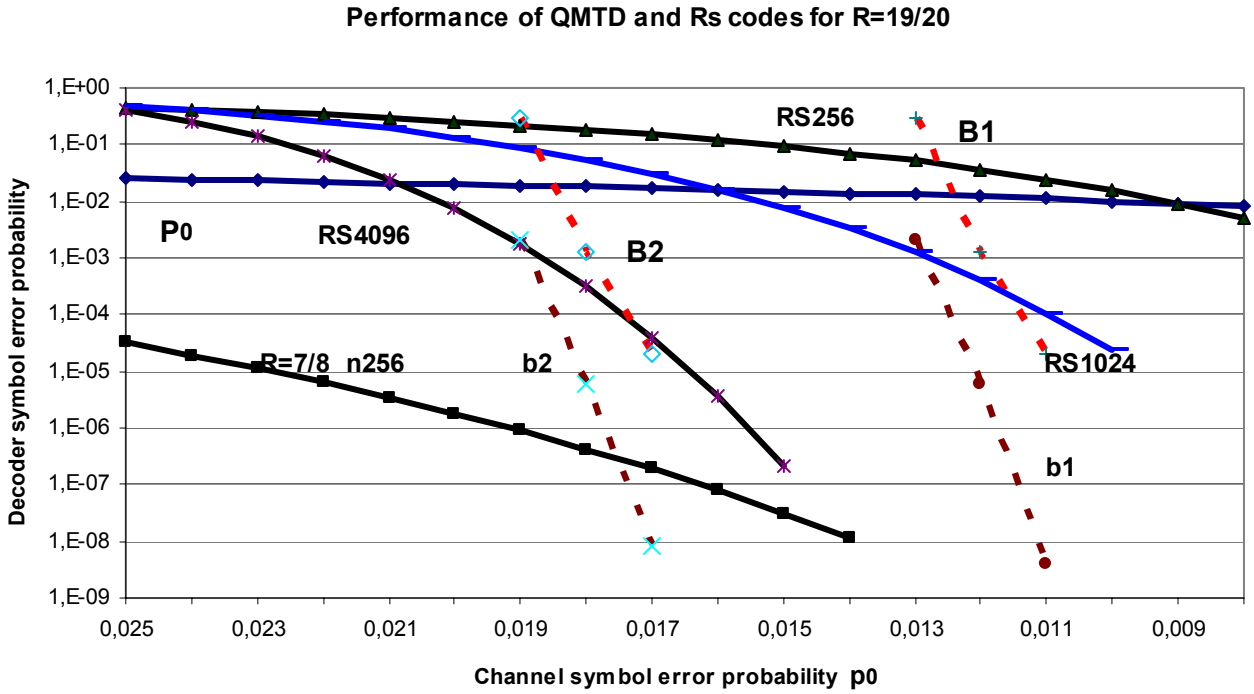


Picture 1.


Performance of QMTD and Rs codes for R=19/20
Decoder symbol error probability
1,E+00
1,E-01
1,E-02
1,E-03
1,E-04
1,E-05
1,E-06
1,E-07
1,E-08
1,E-09
0,025
0,023
0,021
0,019
0,017
0,015
0,013
0,011
0,009
Channel symbol error probability p0
RS256
B1
P0
RS4096
B2
R=7/8 n256
b2
RS1024
b1

Picture 2.