

Your new questions on coding

Question No. 26. You approve, that yours MTD methods appear much more effectively, than all algorithms for codes RS, including and algorithm of Sudan. How it can be, if the method of Sudan works far abroad $d/2$? It means an effective decoding becomes possible for this method at much higher noise level in the channel.

The answer. Really, the method of Sudan allows in asymptotic to correct effectively errors which weight is more, sometimes it is essential more on absolute size (but not on relative increase in this weight!) for long RS codes, than their usual quantity defined by border $d/2$ for these codes classical decoders. We must remind also, that complexity of Sudan algorithm is proportional already n^3 , instead of n^2 , as for classical algorithm, n - block code length. Giving due to a lot of new mathematical results which have been received at creation of new Sudan algorithm, we shall emphasize, nevertheless, this fact as of large decoder complexity, which one is frequently ignored. But at realization of codes with the length n of the order $10^4 - 10^5$ symbols it is received, that the Sudan algorithm in the same times is more complex, than standard RS decoder. And here it is necessary to specify and that real RS codes of length more than 256 are not used, because at longer codes of this type complexity even the usual classical decoder quickly accrues, while efficiency increases much more slowly.

The big number of articles about non-binary MTD and RS codes with **diagram** of their efficiency and estimations of complexity you can find on this web-site www.mtdbest.iki.rssi.ru, as well as 2 demo software programs for these codes which will help you to visualize process of comparison of decoders and to reflect on **their** results at your personal computer in comfortable conditions. We shall notice, that we specify a difference in complexity of decoders of discussed decoders as 10^9 – **billion times** - even for not so long codes with length of the order 30'000 symbols. At length $n=100'000$ difference in complexity relative to MTD will already exceed a level 10^{10} - more then enough?!!

And now - about efficiency at such truly terrible (?) increase in RS decoder complexity. As is known, RS codes are used in many hundreds updates in thousand kinds of product. But usual RS codes – (they are short!) - are ineffective, as they still are low redundant, with code rate of the order $R=7/8$, and sometimes even with higher values R . Therefore it is necessary to apply concatenations of RS codes, that raises efficiency of coding a little, but demands increase of code redundancy and a very big growth of length of such concatenations design.

And now in a low redundant code even they can admit that the errors which are being below a new border for Sudan algorithm - $(1-\sqrt{R})$ in comparison with classical border $(1-R)/2$ are all corrected (these are borders for number of

errors corrected. Then at $R=7/8$ the weight of corrected errors increases only at 4 %. In the case of long codes when it is possible to use codes with $R=0,95$, the number of corrected errors increases approximately for 1 %. Clearly, that in both cases it makes very small growth of a possible noise level for real parameters of codes in a Sudan method whereas its complexity increases for long codes on many decimal powers (see above!) in comparison with a classical method. And if they notice, that symbolical (non-binary) MTD is much more effective than the classical decoder for codes RS Sudan algorithm as it actually corrects almost as much errors in low redundant codes, as well as the usual algorithm for RS codes, also practically it will be much weaker, than MTD. So real QMTD opportunities appear even more significant at comparison with Sudan algorithm than with usual decoders for RS codes if they compare them on parameters set of efficiency and complexity.

Thus QMTD - the absolute champion on these parameters and now it is difficult to see presence of any other non-concatenated methods comparable to it.

At last, we shall specify, that there were our publications under concatenated schemes of symbolical MTD which as it already became habitual, also appear extremely simple at different methods of realization, but also on many decimal powers more noiseproof in comparison even with usual QMTD.

We shall remind ones more, that you can copy demo software decoders of RS codes and QMTD, and also many other demo software decoders, at this our web-site www.mtdbest.iki.rssi.ru and to start all these demo at the personal computer. You will see a lot of interesting!