Again the new book about MTD!

To attention of experts!

In this 2006 for a long time expecting the book appears about multithreshold decoders (MTD) «Theory and Algorithms of Multithreshold Decoding» by V.V.Zolotarev under editing of the member - correspondent of the Russian Academy of Sciences U.B.Zubarev. The positive review of the monography is written by the academician of the Russian Academy of Science V.K.Levin. Work on preparation of its appearance is made by publishing houses «Radio and Communication» and «Hot Line - Telecom», **ph. (+7 495) 737 39 27** in Moscow. Expected time of occurrence of the book for counters of shops and in the Internet - IV quarter of this 2006. Its volume is ~17 p.l. This one is first full enough and systematized statement of the theory and concrete methods of realization for powerful and simultaneously simple technological method of error correction in channels with the large noise level.

The circulation of the book and its availability will depend on the number of its potential and real readers. It is intended (as well as our specialized bilingual website of the Space research institute of the Russian Academy of Science containing up to 200 units of materials about codes **www.mtdbest.iki.rssi.ru**,) first of all to provide domestic developers of the modern equipment of communication with new technologies of authentic digital stream transmission in conditions of extended channels with the large noise level. Applications for the book purchase can be sent to us on a site. But it is more expedient to address directly on a site of publishing house «Hot Line – Telecom», which has undertaken also work to be engaged in distribution of this book. On a site of publishing house it is possible to come directly from the second educational page of our site or here: **(http://www.techbook.ru , ph:. (+7 495) 737 39 27** in Russia**).**

Considerable opportunities open thus and for our experts directly engaged in development of new classes of algorithms of decoding as it will show to them system advantages of decoding on MTD algorithms basis.

You will see a provisional table of contents of the book on our site next month. It will be much more closer to the real, behind exception, probably, one - two paragraphs among six chapters of the book. As the author in the beginning of the book writes, «it can be not deprived the certain lacks … ». But with its appearance the main argument of those loses force who knows nothing about this elementary and very effective method: « But it is not known about it anything… ». Here they, certainly, were right. A site – is not for them, in fact it is not the book.

Let's remind, what the basic advantages of the methods suggested in the monography of V.V.Zolotarev will consist in.

MTD algorithms converge to the optimum algorithms decision at its linear realizations complexity in channels with the large noise. In other words, not being optimum, they rather easily and quickly almost always reach the optimum decision even at high enough noise level of the communication channels.

MTD simply decodes very long codes for which ones is only possible effective realization of error correction at the large noise of the channel.

MTD can use many types of block and convolutional codes among which most allocated self-orthogonal ones are with especially simple realization of their decoding.

The book about MTD represents the unique edition in which it is continuously underlined unity of block and convolutional codes, their unity is emphasized. In global practice of coding problems research till now still is not overcomed of these classes of codes whereas MTD even by their the base properties emphasize their interrelation.

The average operations number in MTD at efficiency comparable to another codes is almost at 2 decimal exponents less, than for other methods that allows to create especially productive program versions of these algorithms. There are codes and concrete programmed the MTD algorithms already accepted to standardization. It is the rare case for development of digital communication techniques.

MTD algorithm –is a unique iterative procedure which supposes ideal full multisequencing carried out operations that is especially convenient at their realization in various PLIS, for example, Xilinx and Altera. In this case the VLIS architecture is built in such a manner that the decoder as though at all does not spend for operations with the data of the syndrome register of any time, but by the moment of the decision forming about decoding symbols the signal of an error estimation for accepted bit is already always has been generated. So registers in MTD decoder can move the data with a maximal chosen technology rate. And they are speeds in hundreds megabits for an every register whereas the number such simultaneously and in parallel working registers in the decoder can reach many tens. Means, for any required speed of decoding search for such a rate, which will realize usual registers shifts with some limiting speed for itself. And if that speed which this supposes PLIS, does not suffice, they recalculate parameters of the decoder for such a number in parallel working registers which total productivity will be enough. Now we create such and only such decoders with productivity approximately on 3 decimal exponents greater, than for their potential competitors. Just therefore binary MTD decoders have no equal ones among all other algorithms for high-speed communication channels, possessing thus enviable energetic characteristics. This only technological and circuit border for decoding algorithms already could not be improved. The closest analogy of this situation – achievement of absolute temperature zero in physics, achievement by a physical body light speed or creation of the engine with quatient equal 100 %. But they will be never achieved. It is impossible. And decoder throughput limit which one already cannot be increased, is already achieved. And everything works!

For non-binary channels codes and its MTD decoders are offered very simple for realization without operations of multiplication and division in non-binary fields.

They are 20 years old. At relatives on noise level operating conditions their characteristic on error probability are at 2-3 decimal exponents and more better than at any decoders of codes of Read-Solomon. As well as in binary codes, it is connected by that MTD successfully, very simply and almost optimum decodes rather long codes, such which evn teoretically cannot be constructed in a class of RS codes. We shall notice, that among non-binary codes it is very difficult to create and effective Viterbi algorithm. So non-binary MTD is a fine example of completely unique and extremely effective decoder with which any known non-binary code and the decoders of other classes cannot be absolutely compared. And as we know huge number of various variants of RS codes application it means, that the necessity for non-binary codes is extremely great, and opportunities are very much limited only by RS codes. So take majority decoded codes and realize non-binary MTD. It will provide with the elementary methods increase of reliability stored on CD-ROMs or the transmitted digital data after correction of mistakes at many decimal exponents better then with RS codes. So non-binary MTD open essentially new degrees of quality and integrity of digital symbolical data streams of which even founders of RS decoders did not dream. And non-binary MTD is also very simple.

MTD is possible to apply and for simultaneous with noiseproof coding data compression. It is very important, that for some types of sources compression is realized at a level very close to theoretically limiting possible one. And, that is very essential, such MTD are not afraid even of high density of mistakes in the received packed streams. All of them always restore the data with required high quality, at all not finding out any attributes of "fragility" of the information when distortions in the transmitted data result in the large error packets in the restored unpacked information.

And for channels with erasures MTD work almost at the channel capacity, on many orders reducing a portion of the erased symbols in comparison with their initial density in an entrance digital stream. Similarly, it is practically unattainable for other methods. Thus MTD appears even easier, than for channels such as BSC though and this decoder does almost nothing do (Joke!).

Concatenated circuits for MTD are unique. Practically always it is possible, if it is necessary, to make so that at the second stage of decoding the code rate R_1 of this second error correction stage actually coincided with code rate R_0 of total concatenated code as a whole. And in fact it is usually the second stage decoder in the consecutive concatenated circuit works at rate $R_1 \approx 0,8 \div 0,95$, i.e. it is initially much less effective a code with code rate R_0, $R_0 << 1$. Substantially for this reason MTD for concatenated codes are especially effective, being thus very simple, as well as usual base MTD algorithms.

Effective MTD for parallel codes are especially convenient. Probably, these codes for MTD have appeared much earlier then all other parallel methods of coding at all .

In concatenated codes with control parity codes in external cascades which are formed only by the unique half-adder, complexity usual MTD also is kept, and characteristics of signal energy in such a decoder at once appear to be higher, than

even at rather powerful concatenated codes with Viterbi algorithm and RS codes. But in fact the decoder of RS code has not in fact one half-adder, and at all not one thousand elements, and quite large device on complexity.

Perfectly works MTD as well with various complex multipositional systems of signals which well compress a spectrum concerning traditional binary system FM-2. Good results are received for MTD at use with unequal bit protection codes, with non-uniform power of channels, in case of application MTD for codes with the allocated branches and in general, these decoders practically instantly adapt for any other conditions of application in communication systems.

And if you do not have “soft” modem at which presence only and probably application of the majority of other effective algorithms MTD in this case will be simplified essentially, and some decrease in its characteristics on energy one will be rather imperceptible.

The major step of designing MTD - optimization of many hundreds its parameters. It is a fine example of use of powerful computer technique and the same methods of adaptation and optimization which realizes actually MTD, in designing these outstanding algorithms. Thus additional increase of resulting reliability of decoding due to substantial improvement of characteristics MTD, sometimes at $1 \div 2$ decimal exponents, without any increase in number of operations in its final variant of application after performance optimization is achieved. Any other methods of error correction have no such powerful additional means of efficiency increase without any increase in its complexity.

Opportunities MTD on the coordinated mutual exchange between values of its parameters are boundless: memories, delays, numbers of operations, productivity, the sizes, redundancy, noise level of the channel and a code gain. Always it is possible to choose such parameters, that under any practically consistent technical project on the decoder it is possible to realize and create the required device of MTD class.

Well, and at last, we would like to emphasize, that all these completely basic practical results are investigations of serious theoretical researches. But we shall not repeat them. They are also in the book!

All this, as well as a number of other useful properties MTD algorithms, are considered in the book which will be soon accessible to all.

So send applications in publishing house, read the new book about MTD, study, create and apply these decoders at a level of the highest standards.

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