The Digital Satellite Communication Channel Simulator
with the Best Systems of the Veracity Providing

NIIRadio and Space Research Institute RAS, Moscow, Russia, suggest a completely unique computer exploratory and technological test bench - system of imitation of digital data transmission through satellite and other communication channels. It contains practically all modern most effective systems of veracities increase used in actual communication networks or only   published in specialized scientific issues on telecommunications.

The Simulator and the numerous noiseproof coding systems, presenting in a structure of its software, are indispensable for the specialists engaging in development of digital data transmission networks. The Simulator allows them to evaluate a feasibility in systems, developed by them, of different correcting codes decoders. It creates for them a capability of exact designing of all devises of created new communication systems with the count of demanded levels of power efficiency, complexity, speed and reliability of implementation, delay of decision making and other yardsticks for selection of veracity increase systems. Modern coding systems became   so composite   for understanding by the technicians engaging adjacent problems, that the acceptance of the exact solutions about these major components of communications networks became an extraordinary problem. The application of the Simulator in process of communication system design completely removes this problem.

Analogues of our Simulator even approximately comparable to it on quality and a representation volume of analysis outcomes, work convenience   and, **- it is a main issue!** - variety of the most effective coding methods, realized in it, now **anywhere in the world simply does not exist.**

Let's point out, that very many capabilities for research and analysis of coding methods, which one are provided with application of our "Simulator", are really absolutely unique. It is into to simulation features of Viterbi algorithm with the encoding register length up to K=20 (!!!), to a capability to analyze directly on a screen characteristic of the very many turbo codes and to esteem applicability of multithreshold decoders (MTD) and some other the most potent algorithms at decision making delay up to one million and more bits. The application of the Simulator will supply a capability to have a look approximately at 10 years forward in the future of coding engineering, to analyze potentials till only designed systems and algorithms, which ones are published in the latest magazines on coding. Let's point out in this connection, that the software of the simulator permanently and rapidly renovated, that allows to watch a level of the best world achievements in engineering and technology of noiseproof coding.

Among large number of methods, live in the software of the simulator, it is possible to select and fast to test in a modeling channel customary majority decoders, simulators of BCH codes decoders, standard and special versions of

Viterbi algorithm, miscellaneous versions of encoders with application of serial and parallel type concatenation, including large number of different versions of turbo code decoders with tuned up parameters of both included codes, and used interleaves. It is a much attention is given also to creation and realization of different LDPC decoders by the developers.

The major place in the software of the Simulator is taken by algorithms of multithreshold decoding (MTD). This most interesting and long development of NIIR is now successfully finished and is quite ready to application in the diversified transmission data systems with the high requirements to a data exchange veracity. On set of yardsticks of a implementation simplicity and power efficiency the MTD methods far advance all other known now developments and prolong successfully to develop further. All the main and the most effective versions of MTD algorithm are also included as optional versions of methods for a transmission data accuracy increase in a structure of the software of the Simulator and demonstrate the very high actual characteristics of this unique algorithm, which one is completely designed by the Russian specialists.

For more full familiarization with MTD algorithms we suggest to acquaint closely with stuffs, submitted on a specialized web-site www.mtdbest.iki.rssi.ru , and also to acquaint with the review on coding, placed in a head magazine of Ministry of Communication in Russia, Moscow, "Electrosvaz", 2003, № 9, pp. 34-37.

Besides in March 2004 in publishing house "The Hot Line - Telecom", Moscow, for the first time in Russia appears "The Reference Book on Noiseproof Coding", where different methods of error correction in channels with a large noise level also are reviewed, which ones efficiency can be analyzed comprehensively with the designed Simulator help.

On the reference coding book acquisition, including part of circulation under the very preferential rate scales as contrasted to by retail trade system is possible also to address to us, the reference book authors or directly to publishing house "The Hot Line - Telecom", Moscow.

The necessary information on this publishing house can be found on its web-site www.techbook.ru , or to address to the publishing house in Moscow: tel. +7 095 287 15 03, +7 095 287 49 56.

Let's specify for brevity only few of the major characteristics of the Simulator of a digital communication satellite channel of with the best systems of veracity increase", intended for research of different decoding algorithms efficiency for noiseproof codes in channels of a different kind.

The system provides to the specialist working with it, intuitively understandable user interface. During work all simulation results are imaged as text in a browser of outcomes. The mapping capability for error decoding probabilities graphs for different signal-to-noise ratio values in communication channel is stipulated. The convenient capability for the obtained charts export in Microsoft EXCEL is realized also.

The Simulator is built on the basis of high-velocity portable computer with following main specifications:

- The IBM-compatible computer on the basis of processor with clock rate 1 GHz (at least 2,6 GHz is recommended);
- RAM size - 256 Mbytes;
- Operating system Windows 98/2000/XP.

Now the Simulator provides research of following methods of error correcting efficiency:

1) The Viterbi algorithm (VA) for convolutional codes decoding with coding register length up to K=20 and code rate R=1/2 and above (for obtaining higher code speeds it is necessary to use puncturing);

2) Multithreshold decoding (MTD) algorithm of block and convolutional self-orthogonal codes with code R=1/11 ÷ 10/11 and code distance **d** from 1 up to 20;

3) Concatenated coding circuits on the basis of multithreshold decoder;

4) The algorithms of turbo codes decoding with code rate R=1/3 and are higher (large code rates may be reached by puncturing using); the parameters adjustability of component codes and algorithms of their decoding, length and kind of interleaver, decoding iterations quantity is stipulated.

The research of listed codes is possible in following channels models:

1) channel with additive white Gaussian noise and binary phase modulation; in the given model the set-up of following parameters is possible :

- Signal-to-noise ratio E_s/N_0, dB (from -10 dB up to 10 dB);
- Number of quantizing levels of the demodulator decisions (from 2 up to 64);
- Solution areas bounds of the soft modem;
- Corresponding to each area of quantizing value of an demodulator output (used metrics);

2) Channel with additive white Gaussian noise and M-ary phase modulation;
 in the given model the set-up of following parameters is possible:

- Signal-to-noise ratio E_s/N_0, dB (from -10 up to 10 dB);
- Quantity of points of signal set (from 2 up to 64).

For maintenance of indispensable accuracy of the Simulator imitation the channel models testing is stipulated, and also the broad variability of experiment parameters, in particular are accessible:

- Volume of experiment;
- Kind of transmitted information sequence (zero, single, random and instituted by the user);
- Number of errors at the output of the decoder, after which it is necessary to stop the simulation.

At the customer wish any new methods of error correction, special models of communication channels, the communications protocols and another software improving an overall effectiveness of the explorers and the developers of new communication systems which are indispensable for design works, can be operatively included in the Simulator.

For consulting about **<u>applications and selling</u>** of our unique test bench - the Simulator for digital satellite channels   and modern systems of the veracity increase you may call to address:

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