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Performance Enhancement of Wireless Communication System using MTC over CTC with Improved BER

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ABSTRACT

This research paper presents the comparison of BER for CTC, LCHTC and ILCHTC in wireless communication channel. It is observed that ILCHTC shows better error convergence over LCHTC. Also, in term of BER performance, ILCHTC is better than LCHTC. Error rate convergence of rate R=1/3 CTC is best out of the research. CTC shows better error convergence than the MTC but decoder complexity of CTC is more than that of MTC. BER is nearly constant up to E_b/N_0 =1.28dB for MTC and there is a difference of nearly 10^{-3} in BER for rate R=1/3 CTC and MTC.

Keywords: CTC, MTC, LCHTC, ILCHTC, BER, RATE.

I. INTRODUCTION

Turbo codes used in the channel coding scheme play a major role in the system of wireless communication [1]. Turbo codes are being accepted as the standard of 3GPP due to their exceptional performance in personal communications. In next era of wireless communications, mainly the 4G applications, there is a need to provide the best Quality of Service-QOS provisioning [2-4]. For transmission like text transmission and packet loss intolerable while delay is acceptable. But for real time video, there can be degradation in video which should be acceptable. But the delay in the system cannot be accepted [5-6]. Turbo codes are the most adaptable and preferred error coding scheme. It is used to adapt to the varying type of QOS requirement.

II. METHODS AND MATERIAL

The model designed for calculation of BER for Convolutional turbo code is shown in figure 1. The simulation model is designed using Simulink using Matlab [7]. In this, section we computed BER at different E_b/N_0.

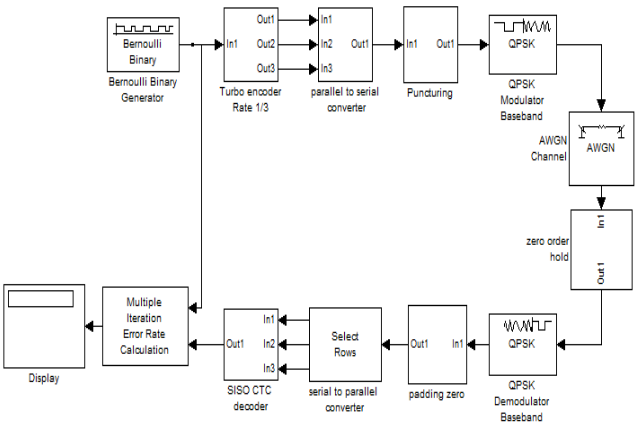

Figure 1. Model of simulation for Turbo Codes

Turbo encoder is shown formed by parallel concatenation of two convolution encoders is separated by an interleaver [8]. Turbo code follows the idea given as:

- The two encoders used are normally identical;
- The code is in a systematic form, i.e. the input bits also occur in the output

The interleaver reads the bits in a pseudo-random order [9-10].

Other, than this Puncturing, QPSK modulation scheme with PISO in encoder and SISO in decoder side plays an important role in improvement of BER performance of MTC.

III. RESULTS AND DISCUSSION

Comparison of BER for CTC, LCHTC and ILCHTC in AWGN channel is illustrated in figure 2. ILCHTC shows better error convergence than LCHTC.

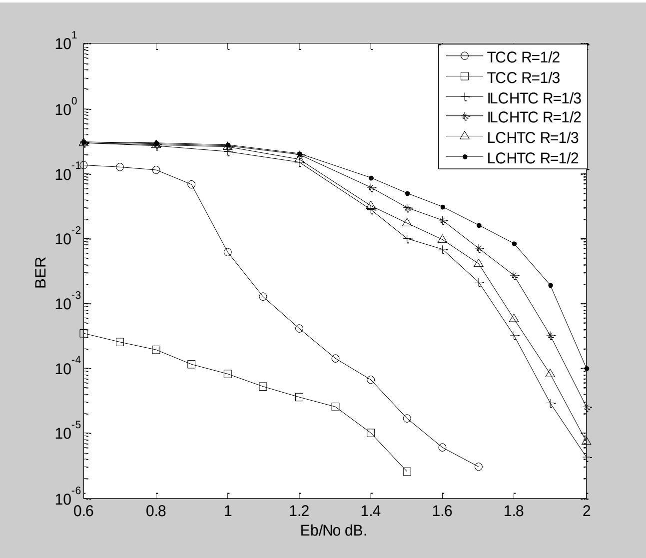

Figure 2. Comparison for MTC and CTC basis of BER

In term of BER performance, ILCHTC is better than LCHTC because in ILCHTC information bits are decoded using zigzag decoder as well as RSC decoder. RSC decoder shows better error convergence than zig-zag decoder. While in LCHTC, first zigzag parity bits are decoded using RSC decoder, then using these parity bits zigzag decoder decode information bits. Error rate convergence of rate CTC is best out of the code presented. CTC shows better error convergence than the MTC but decoder complexity of CTC is more than that of MTC

Table 1 shows comparison of E_b/N_0 to achieve a particular value of BER for CTC and MTC.

Table 1 Comparison of BER and SNR for MTC and CTC

Code Type	E_b/N_0 (dB) ≈ , for			
	BER $=10^{-2}$	BER $=10^{-3}$	BER $=10^{-4}$	BER $=10^{-5}$
R=1/2 LCHTC	1.8	1.95	2	2.2
R=1/3 LCHTC	1.6	1.8	1.9	2
R=1/2 ILCHTC	1.7	1.85	1.95	2.1
R=1/3 ILCHTC	1.5	1.7	1.85	1.95
R=1/2 CTC	1	1.1	1.4	1.6
R=1/3 CTC	0.2	0.4	1.1	1.4

According to simulation results shows that BER is nearly constant up to E_b/N_0 = 1.2 dB for MTC and there is a difference of nearly 10^{-3} in BER for rate R=1/3 CTC and MTC. Rate R1/3 CTC shows much better performance for low signal to noise ratio. But at higher signal to noise ratio BER performance for CTC and MTC is nearly same. Simulation results show that BER~$8x10^{-6}$ at = E_b/N_0= 1.2 dB is achieved for R=1/3 LCHTC which is 0.5 dB away from E_b/N_0 for the same BER for R=1/2 CTC. Simulation result shows the difference in the BER performance for different rate MTC. BER~$4x10^{-6}$ is achieved at E_b/N_0= 2 dB for rate R=1/3 ILCHTC which is only 0.4 dB away from E_b/N_0= 1.2 dB for the same BER for R=1/2 CTC. Table shows that BER performance of MTC is improved. Rate R=1/3 ILCHTC shows a gain of 0.1dB over rate R=1/3 LCHTC to achieve a BER=10^{-4}.

IV. CONCLUSION

It is concluded that in this research work BER performance of MTC is better than the BER performance for CTC for code rate 1/2. Other than this it is obtained that decoder complexity is reduced by a factor of nearly two for MTC as compared to CTC. Loss of BER performance is negligible. BER performance loss at some point is compensated by reduction of decoder complexity Memory requirement is very much less for decoding MTC as compared to CTC.

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