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DVB-S2 IMPLEMENTATION USING VARIOUS MODULATION TECHNIQUES USING CODES

***Sukhmeet Kaur Chadha**
Research Scholar Of Electronics And Communication, DBU,Mandi Gobindgarh,India

Abstract

The main aim of the paper is to analyze the BER performance of RS and BCH code in the presence of AWGN channel with QPSK modulation technique at different code rate. The paper analyses the implementation of BCH/RS codes with interleaver, which increases the capability of the correcting errors in the system, thus increases the system performance. An interleaver is added to the system so that use of an interleaver improves the error rate of the communication system in which channel produces the burst error. As Eb /NO increases BER decrease in system (Digital Video Broadcasting – Satellite Second Generation). By using interleaver with BCH or RS codes there is decrease in BER and thus improvement in the performance of the system
Index Terms- AWGN Channel, BCH, Block Interleaver, buffering, LDPC and RS Codes.

I.INTRODUCTION

In digital data transmission, on account of noise error occurs. Error control coding aims at developing methods to check the correctness of the bit stream transmitted for coding. The codeword of that symbol is called the bit stream representation of a symbol. [5]
The probability of error or bit error rate depends on the S/N ratio, the modulation type and the method of demodulation.

The bit error rate p, may be expressed in terms of
P= no. Of error in N bits for large N (N tends to infinity) N bits
The term error-control coding has been used in both associations with the commercial and military communications systems. It is an authority under the branch of applied mathematics called Information Theory, discovered by Claude Shannon in 1948.
Error-control coding are used in its several forms and is used in almost every new martial communications system including the Joint Tactical Information Distribution System (JTIDS) and the Jam Resistant Secure Communications (JRSC) system employed on the Defence Satellite Communications System (DSCS).

One of the most used techniques in information theory is a method called coding, which is intended to optimize transmission and to make efficient use of the capacity of a given channel.

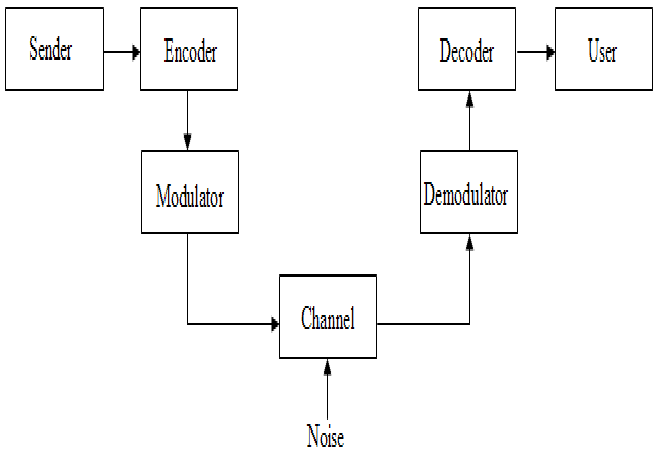


Fig 1. Digital Communications System

Error-control codes are now used in approximately the entire range of information communication, storage and processing systems. Rapid advances in electronic and optical devices and systems have enabled the implementation of very influential codes with close to best possible error-control performance. In addition, new types of code and new decoding methods have recently been developed and are starting to be applied. However, error-control coding is complex and unfamiliar, not yet widely understood and acceptable.

1.1 ROLE FOR ERROR-CONTROL CODING

Error-control coding helps to make a difficult channel satisfactory by lowering the frequency of errors events. The error of events could be bit errors, message errors or undetected errors. Coding's role is to do following-

1. Reduce the occurrence of undetected
2. Reduce the cost of communications 3 .Overcome Jamming
3. Eliminate Interference

II. INTRODUCTION TO VARIOUS CODES

BCH CODES

The BCH abbreviation stands for the explorers, Bose and used as part of the forward-error-correction strategy of digital chaudhuri (1960) and separately hocquenghem (1959). BCH code can be designed to correct any arbitrary number of errors per code block. One of the key features of BCH codes is that during code design, there is a precise control over the number of symbol errors correctable by the code. In particular, it is possible to design binary BCH codes that can correct multiple bit errors. Another advantage of bch codes is the ease with which they can be decoded, namely, via an algebraic method known as syndrome decoding. This simplifies the design of the decoder for these codes, using small low-power electronic hardware.

BCH DECODING

The Decoding of BCH code is performed in three steps:-

1. Syndrome is calculated from the received codeword.
2. Error location polynomial is found from a set of equation derived from the syndrome.
3. Error location polynomial is used to identify and correct the errant bits. [15]

ADVANTAGES OF BCH CODES

1. The principle advantage is the ease with which they can be decoded using 'syndrome decoding' method.
2. Highly flexible, allowing control over block length and acceptable error thresholds, meaning that a custom code can be design to a given specification.
3. Easy to implement in hardware.
4. Widely used in ATM, industrial purposes.
5. Allows very simple electronic hardware to performs the task, obviating the need for a computer, and meaning that a decoding device maybe small and low-powered.

LDPC CODES

LDPC codes are block codes, i.e. a block of data is encoded into a codeword on the contrary to convolutional codes where a continuous data steam is encoded. In information theory, a low- density parity-check (LDPC) code is a linear error correcting code, a method of transmitting a message over a noisy transmission channel. [1]

An LDPC is constructed using a sparse bipartite graph. LDPC codes are capacity-approaching codes, which means that practical constructions exist that allow the noise threshold to be set very to the theoretical maximum (the Shannon limit) for a symmetric memory less channel. The noise threshold defines an upper bound for the channel noise, up to which the probability of lost information can be made as small as desired.

LDPC codes are finding increasing use in applications requiring reliable and highly efficient information transfer over bandwidth or return channel-constrained links in the presence of corrupting noise.

REED-SOLOMON CODES

Reed-Solomon codes are random single- or multiple-symbol error correcting codes. Operating on symbols which are elements of a finite field. The coefficients of the data polynomial and the check symbols are elements of the field, and all encoding, decoding and correction computations are performed in the field. Reed-Solomon is symbol oriented and the circuits implementing them are typically clocked once per data symbol, although bit- serial techniques are also employed. Reed-Solomon codes are transmission of signals in the four proposed all digital HDTV systems.

Reed Solomon is an error correcting coding system that was devised to address the issue of correcting multiple errors especially burst type errors in mass storage devices (hard disk drives, DVD, barcode tags), wireless and mobile communications units, satellite links, digital TV, digital video broadcasting (DVB), and modem technologies like xDSL . Reed Solomon codes are an important subset of non binary cyclic error correcting code and are the most widely used codes in practice. These codes are used in wide range of applications in digital communications and data storage. Reed Solomon describes a systematic way of building codes that could detect and correct multiple random symbol errors. [14]

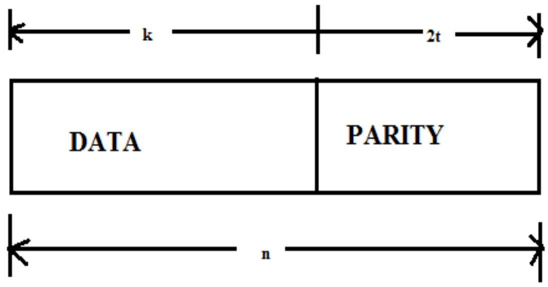


FIG 2. The Structure Of RS Codeword

III.INTRODUCTION TO INTERLEAVING

Interleaving is frequently used in digital/satellite communication and storage systems to improve the performance of forward error correcting codes. Many communication channels are not memoryless errors charactertically occur in bursts rather than independently. If the number of errors within a code word exceeds the error-correcting code's capability, it fails to recover the original code word. Interleaving ameliorates this problem by shuffling source symbols across several code words, thereby creating a more uniform distribution of errors. Therefore, interleaving is widely used for burst error-correction. There are two types of interleaving block and convolution interleaving. Here, block interleaving is used for implementation.

3.1 BLOCK INTERLEAVING

A block interleaver understands a set of symbols and rearranges them, without repeating skipping any of the symbols in the set. The number of symbols in each set is fixed for a given interleaver. [6]

An interleaver permutes symbols according to a mapping. A corresponding deinterleaver uses the inverse mapping to restore the original sequence of symbols. Interleaving and deinterleaving can be valuable for reducing errors caused by burst errors in a communication system.

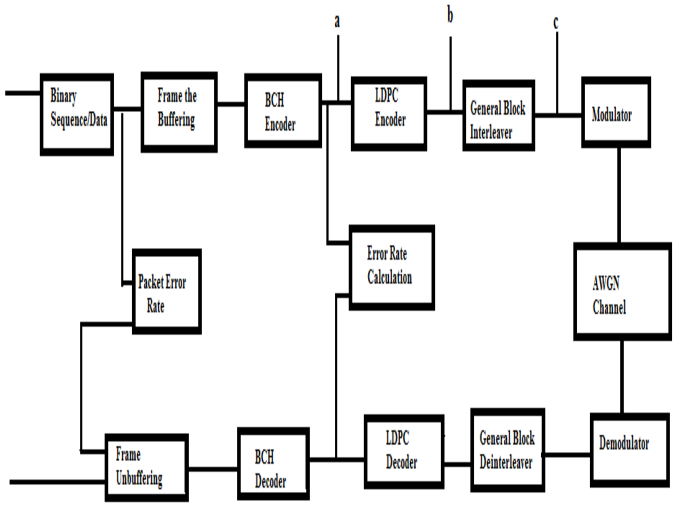
Each interleaver function has an equivalent deinterleaver function. In typical usage of the interleaver/deinterleaver pairs,the inputs of the deinterleaver match those of the interleaver, except for the data being rearranged. The set of block interleavers in the toolbox includes a general block interleaver as well as several special cases. The interleaver power is chosen based on worst case channel conditions. It must be large enough so that the interleaved code can handle the longest error bursts expected on the channel.

IV.INTRODUCTION TO DVB-S2

DVB-S2 is the second-generation design for satellite broad-band applications, developed by the Digital Video Broadcasting (DVB) Project. The system is structured as a toolkit on the way to allow the execution of the satellite applications TV and sound broadcasting, interactivity (i.e., Internet access) and professional services, such as TV contribution links and digital satellite news gathering.[7][8]

The DVB-S2 (Digital Video Broadcasting – Satellite 2nd generation) system has been developed as the development of first generation DVB-S system, to increase the custom data rate in the same channel bandwidth.

BLOCK DIAGRAM OF DVB-S2 IMPLEMENATION



V. METHODOLOGY

1. The tool used for performing implementation of DVB-S2 with RS and BCH codes using both one by one with and without interleaver using different modulation techniques at different code rates by using MATLAB coding.
2. Binary sequence or an information symbols are sent to the “frame the buffering”.
3. The data is send at different code rates like 1/2, 1/3, 1/4 to “frame the buffering”. Code rates decide at which speed data is send to the encoder.
4. BCH encoder maps each of the input sequences to unique symbol sequence known as code word. The generated code word is then passed to the next module known as LDPC encoder.
5. LDPC encoder will check the low density parity check and also check the length of the code after LDPC; BER is calculated and then send to “Gen-

eral Block Interleaver".

6. Through Block Interleaver Data is set and rearrange the symbols without repeating and skipping any of the symbols in the set. It must handle the longest error burst expected on the channel basically block interleaver passed the data equivalently to the modulator.
7. Then the coded message is modulated on to a carrier via. different modulation
8. The channel is prone to different noises like man made noises and other disturbances which can corrupt the data before the data is sent data can be decoded it had to be separated from the carrier waves by using AWGN channel.
9. The decoded data is sent to the decoder at the receiver's end which decodes data into original information sequences in this BER is calculated.

VI. RESULTS AND DISCUSSIONS

TABLE I. ES/N0 PERFORMANCE AT QUASI-ERROR-FREE, 10E-7 AWGN CHANNEL FOR QPSK ¼

QPSK 1/4	Es/N[db]	Simulated BER	LDPC BER
DVB-s2	-2.54	1.782e+5	5.713e-5
DVB-s2	-2.53	1.782e+5	0
Proposed DVB-s2	-2.53	1.882e+5	0
Proposed DVB-s2	-2.54	1.233e+5	4.456e-6

TABLE II. ES/N0 PERFORMANCE AT QUASI-ERROR-FREE, 10E-7 AWGN CHANNEL FOR QPSK 1/3

QPSK 1/3	Es/N[db]	Simulated BER	LDPC BER
DVB-s2	-1.54	2.382e+5	3.713e-6
DVB-s2	-1.43	2.482e+5	0
Proposed DVB-s2	-1.43	2.345e+4	0
Proposed DVB-s2	-1.54	2.782e+5	5.753e-6

TABLE III. ES/N0 PERFORMANCE AT QUASI-ERROR-FREE, 10E-7 AWGN CHANNEL FOR QPSK 1/2

QPSK 1/2	Es/N[db]	Simulated BER	LDPC BER
DVB-s2	0.85	3.564e+5	0
DVB-s2	0.84	3.564e+5	0
Proposed DVB-s2	0.84	2.345e+5	0
Proposed DVB-s2	0.85	3.982e+5	2,789e-7

VII. Conclusion

In this paper performance of RS and BCH codes was simulated in the presence of AWGN channel. Serval iterations were performed to find out which code is better for the DVB-S2 model.SNR ratio was varied from different values and it was noticed that at every value of SNR BCH perform better than RS code.both QPSK and different QAM modulation schemes were used at different code rates again BCH code performs better tan RS code.in this paper ES/N0 performance at quasi-error-free, 10e-7 AWGN CHANNEL for QPSK 1/2 ,1/3,1/4 with BCH code showed as when noise reaches a level where the existing DVB- S2 model gains no quasi error free performance, the new DVB- S2 model shows a quasi free communication.

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