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A Review of Designing of Digital Video Broadcasting with RS Encoding

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Abstract: Digital television broadcasting is present and future of television. With the advent of digital technology, digital audio and video compression and other advanced signal processing, it is possible to transmit and receive broadband data over co-axial cable and through satellite and terrestrial. Digital television is a telecommunication system for broadcasting and receiving moving picture and sound by means of digital signals, in contrast to analogue signals in analogue (traditional) Television. It uses digital encoded data convolute the data and transmit the data with OFDM. Modulation data, which is digitally compressed. DVB is a European digital television standard that uses different modulation techniques like, 16 QAM, 64 QAM. DVB uses Convolutional interleaver for different combination like 1/4, 1/3, 2/3, 3/4 with Reed solemn encoder.

Keywords: DVB, OFDM, BER, RS.

I. INTRODUCTION OF DVB

Digital broadcasting systems provide several mechanisms for transmitting data services to improve the conventional radio and TV services, and these systems also have the capability to support new multimedia services. There are several competing technologies for the broadcasting of digital content. In some parts of the world, we can tune into digital broadcasting on our digital TV set in the living room. The standards that provide this facility include Integrated Services Digital Broadcasting (ISDB), Digital Video Broadcasting (DVB), and Digital Multimedia Broadcast (DMB). These digital broadcast standards are being used in different parts of the world. In Japan, the ISDB standard is used to provide multimedia broadcast services to the terrestrial networks. The DMB standard is based on the Digital Audio Broadcast (DAB) standard and is deployed in South Korea[6]. It allows mobile reception of the multimedia content. The DVB standard is adopted in Europe for digital video broadcasting, and the European Telecommunications Standards Institute (ETSI) has regulated it. Based on these standards, there are several systems that can provide the broadcasting of digital contents. The most common systems include ISDBT, DVB-T, DAB, DMB and DVB-H[7].

(a). Integrated Services Digital Broadcasting (ISDB-T): It is an emerging digital TV broadcasting system developed in Japan to provide flexibility for multimedia broadcasting services using the terrestrial networks. The ISDB-T system uses the Band Segmented Transmission technique (BST), which divides the channel into a set of frequency blocks called segments. The ISDB-T systems are capable of providing a variety of multimedia services to the stationary as well as the mobile receivers. The main drawback of ISDB-T for mobile reception is that the digital TV transmission to the mobile terminals requires high power consumption.

(b). Digital Video Broadcasting Terrestrial (DVB-T): It is a flexible terrestrial system that supports various broadcast service environments ranging from a fixed-rooftop antenna to a portable service. DVB-T also supports mobile reception of the services and content. This standard has been accepted as a common standard for the digital television in Europe and it is the basis of the new emerging standard for reception of the digital television services on the handheld terminals i.e., the DVB-H standard. DVB-T uses the MPEG-2 standard for the compression because it makes it possible to multiplex the separate elementary streams that are associated with the current service and it allows the encryption of all transport streams. DVB-T has the same drawback as ISDB-T; it was not originally designed to target the mobile receivers, and the major problem in receiving the digital TV on handheld devices is the battery consumption. Neither of these systems takes into account the special requirements to support digital TV services on the mobile handheld terminals[6].

(c). Digital Multimedia Broadcasting (DMB): It is a digital transmission system for the delivery of multimedia content and services to mobile phones. It has been developed in South Korea and is the further development of the DAB standard, with additional error correction capability to deliver television services to the mobile handheld receivers even at high speeds. For the error correction, the DMB uses the technique called Forward Error Correction as does DVB-H,

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but the DMB additionally uses the time interleaving to solve the problems of difficult conditions such as impulsive noise, typically found in the mobile environments. The time interleaving works by spreading the errors in time over logical frames so that the receiver can correct the errors, hence, it is very effective. The DMB offers the possibility to work using considerably less power. All of these features make DMB a better choice to be used for delivering digital TV services to the mobile handheld terminals. The only problem with the DMB system is its limited capacity. Scaling up to a large amount of multimedia services on top of DAB/DMB would require frequency reallocation. For high-capacity demand, the DVB-H system would normally be the system of choice[7].

(d). Digital Video Broadcasting Handheld (DVB-H): It is an extension of the DVB-T, which is the current terrestrial digital TV broadcast standard. The DVB-H enables service reception in the handheld devices using IP data. DVB-H network parameters are optimized for mobile usage, and for the handheld devices that have low battery capacity. The DVB-T was particularly designed to deliver broadcast services to the living room TV connected to a continuous power supply with a large rooftop antenna. In contrast, the DVB-H was developed by taking into account the mobile handheld receivers and is optimized for the battery-powered receivers that have internal antennas and small screens. Although, the DVB-T has proved itself to be able to work in a mobile environment e.g., public transportation, the DVB-H overcomes two key limitations of the DVB-T when used for the handheld terminals. Firstly, it lowers the battery power consumption. Secondly, it improves robustness in very hard reception environments both indoor and outdoor. DVB-H reduces power consumption by using a technique called time slicing. The data is transmitted in high-speed bursts and the mobile receiver only wakes up when it has to receive these bursts. The receiver remains in the sleep mode between these bursts, i.e., at all other times. This technique enables the receiver to save power up to 90 percent. DVB-H has the ability to converge with the GSM standard when using the IPDC technology. Mobility and flexibility are obvious benefits of the mobile TV. DVB-H has full potential and capability to deliver large amount of multimedia and digital TV services to the mobile handheld terminals with high data transmission rates. Because of the related features and similarities among basic building blocks in DMB and DVB-H, it is unlikely that two handsets, each having a different mobile TV standard, will end up being vitally different in the reception quality or the power consumption[8].

II. REED SOLOMON ENCODING

Reed–Solomon codes operate on a block of data treated as a set of finite-field elements called symbols. Reed–Solomon codes are able to detect and correct multiple symbol errors. By adding $t = n - k$ check symbols to the data, a Reed–Solomon code can detect (but not correct) any combination of up to and including t erroneous symbols, *or* locate and correct up to and including $\lfloor t/2 \rfloor$ erroneous symbols at unknown locations. As an erasure code, it can correct up to and including t erasures at locations that are known and provided to the algorithm, or it can detect and correct combinations of errors and erasures. Reed–Solomon codes are also suitable as multiple-burst bit-error correcting codes, since a sequence of $b + 1$ consecutive bit errors can affect at most two symbols of size b. The choice of t is up to the designer of the code and may be selected within wide limits. There are two basic types of Reed–Solomon codes – original view and BCH view – with BCH view being the most common, as BCH view decoders are faster and require less working storage than original view decoders.

Properties of Reed-Solomon Codes

RS codes are linear block codes. A RS code is specified as RS(n, k) with m-bit symbols. RS(n, k) codes on m-bit symbols exist for all n and k for which

$0 < k < n < 2^m + 2$

where k is the number of data symbols being encoded, and n is the total number of code symbols in the encoded block, called codeword. This means that the RS encoder takes k data symbols of m-bits each and adds parity symbols (redundancy) to make an n symbol codeword. There are (n – k) parity symbols of m-bits each. For the most conventional RS(n, k) code,

$$(n, k) = (2^m - 1, (2^m - 1) - 2t)$$

where t is the symbol-error correcting capability of the code, and $(n - k) = 2t$ is the number of parity symbols. It means that the RS decoder can correct up to t symbols that contain errors in a codeword, that is, the code is capable of correcting any combination of t or fewer errors.

When a received codeword is fed to the RS decoder at the receiver for processing, the decoder first tries to verify whether this codeword appears in the dictionary of valid codewords. If it does not, errors must have occurred during transmission over a communication channel. This part of the decoder processing is called error detection. If errors are detected, the decoder attempts a reconstruction. This is called error correction.

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III. CONCLUSION

As a special type of error control codes, due to its outstanding error correcting capability on both random and burst errors, Reed-Solomon codes are nowadays widely used in various types of digital communication systems, especially in DVB (Digital Video Broadcasting) systems, HDTV systems, satellite communication systems, and data storage systems.

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