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A REVIEW: EFFICIENT WIRELESS SYSTEM BASED ON MPSK USING DIVERSITY

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ABSTRACT

These days the requirements the increase in the number of wireless devices and the requirement for higher data rates places an increasing demand on bandwidth. The advance generation of wireless communication systems faces the demand for increased higher mobility, data rates, larger carrier frequencies, and more link reliability. Wireless channels are characterized by diversity, fading, multipath, limited bandwidth, and frequency and time variant, time invariant selectivity which make system design a challenges. This necessitates the need for communication systems with increased throughput and capacity. The requirements in wireless communication are to have high voice quality, high data rates, high voice quality multimedia features, lightweight communication devices etc. But the wireless communication channel suffers from much impairment.

KEYWORDS: Fading, Diversity, Fading channels, Combining techniques, Amplitude Shift Keying; Phase Shift Keying; Binary Phase Shift Keying (BPSK); Quadrature Phase Shift Keying (QPSK); QAM; Quadrature Amplitude modulation.

I. INTRODUCTION COMMUNICATION

When we think of communication, we usually think of people talking or listening to each other. This may happen face to face, or it may occur through the assistance of a telephone, radio, or television. Basically, communication is the transfer of information. Life In our modern, complex world depends more and more on the transfer of information. The increasing dependency on the transfer of information has stimulated the growth of more and more communication systems. This surge in communication and communication systems has been referred to as a technological revolution. The communication system will consist of at least the three parts shown. The channel can be as simple as the air that carries the sound of your voice, or as complex as the satellite network required to carry a television program around the world. The most common problem encountered by the communication process is interference. Interference is any force that disrupts or distorts the information or message while it is being "channeled." It could be noise, as in the case of normal conversation, or atmospheric weather changes, as In the case of radio or television. The biggest cause of interference, however, is a simple misinterpretation of the intended message. Cultural, economic, and political diversities allow people to receive the same message but interpret it differently. Communication system is a combination of processes and hardware used to accomplish the transfer of Information (communication).

II Digital communication systems

Fig. 1 illustrates a general block diagram for a digital communication system. In this diagram, digital data from a source are encoded and modulated for transmission over a channel. At the other side, the data are extracted by demodulation, decoding, and then sent to a sink. The encoder can be divided into two blocks, namely the source encoder and the channel encoder.

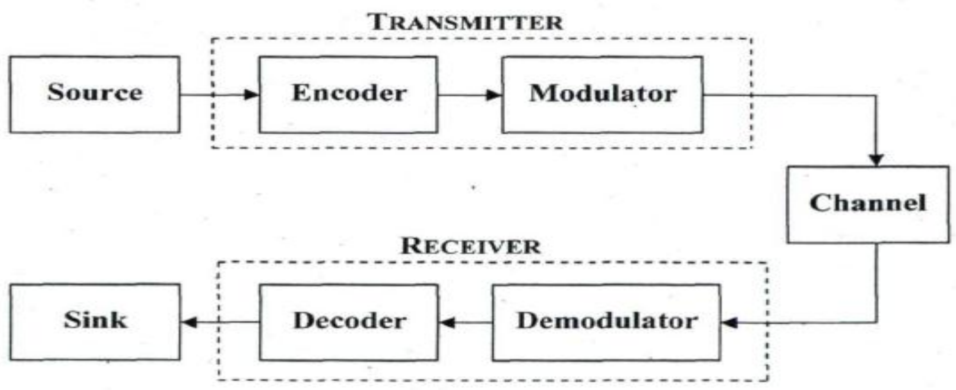

Figure 1: Block diagram of a digital communication system.

In some digital communication systems, channel coding and modulation are combined together; this is called coded modulation. In general, there are two main constraints in communication systems, the available spectrum (or bandwidth) and the power required for data transmission. The bandwidth is becoming a rare commodity with the demand of high speed and high quality of service (QoS) for wireless communications. In this thesis M-ary phase shift keying (M-PSK) used for improving BER performances.

III. Digital Modulation

In digital modulation schemes, binary code modulates the analog carrier signal. The digital modulator device acts an interface between the transmitter and the channel. The digital modulation schemes are categorized basically either on their detection characteristics or in terms of their bandwidth compaction characteristics. The main criteria for best modulation scheme depends on Bit Error Rate (BER), Signal to Noise Ratio (SNR), Available Bandwidth, Power efficiency, better Quality of Service, cost effectiveness . The performance of each modulation scheme is measured by estimating its probability of error with an assumption that system are operating with Additive White Gaussian Noise . Modulation methods which are capable of transmitting more bits per symbol are more immune to error caused by noise and interference induced in the channel The delay distortion can be an important measure while deciding modulation scheme for digital radio. There are various digital modulation schemes which are used in the telecommunication system. The basic types of digital modulation scheme are Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) and Phase Shift Keying (PSK) respectively. The ASK, FSK and PSK with nyquist pulse shaping at the baseband form the basic technique of digital modulation, but other methods are also possible by incorporating two or more basic digital modulation techniques with or without introducing pulse shaping. Thus, hybridized modulation can be designed depending upon the type of signal and the application. The implementation of ASK is simple but they are limited to deliver low amount of power and achieve low data transmission rates. The PSK modulation technique have steady envelope but but discontinuous phase transitions from symbol to symbol. DPSK, QPSK and MSK are the derivatives modulation schemes of the Phase Shift Keying. A better digital modulation scheme is to be contemplated over by the designer which has an ability of exploiting the existing transmitted power and the bandwidth to its full coverage.[48] In paper,[15] author have presented the characteristics of modulation techniques and determined.

IV. Digital Modulation Techniques

Amplitude Shift Keying: ASK is a type of Amplitude Modulation that represents the binary data in the form of variations in the amplitude of a signal. Any modulated signal has a high frequency carrier. The binary signal when ASK modulated, gives a zero value for Low input while it gives the carrier output for High input.

The following figure represents ASK modulated waveform along with its input.

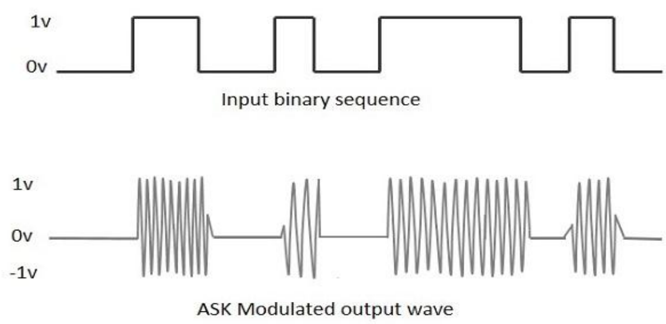

Figure 2: ASK Modulation.

Frequency Shift Keying: FSK is the digital modulation technique where the frequency of the carrier signal varies according to the digital signal changes. FSK is a system of frequency modulation. The output of a FSK modulated wave is high in frequency for a binary High input and is low in frequency for a binary Low input. The binary 1s and 0s are called Mark and Space frequencies. The following image is the diagrammatic representation of FSK modulated waveform along with its input.

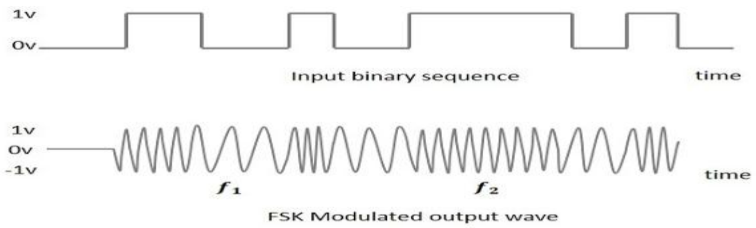

Figure 3: FSK Modulation.

Phase Shift Keying: PSK is the digital modulation technique where the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications.

PSK is of two types, depending upon the phases the signal gets shifted. They are **Binary Phase Shift Keying BPSK.** This is also called as 2-phase PSK or Phase Reversal Keying. In this technique, the sine wave carrier takes two phase reversals such as 0° and 180°. BPSK is basically a Double Side Band Suppressed Carrier DSBSCDSBSC modulation scheme, for message being the digital information.

Quadrature Phase Shift Keying QPSK: This is the phase shift keying technique, where the sine wave carrier takes four phase reversals such as 0°, 90°, 180°, and 270°. If this kind of techniques are further extended, PSK can be done by eight or sixteen values also, depending upon the requirement.

BPSK Modulator: The block diagram of Binary Phase Shift Keying consists of the balance modulator which has the carrier sine wave as one input and the binary sequence as the other input. Following is the diagrammatic representation.

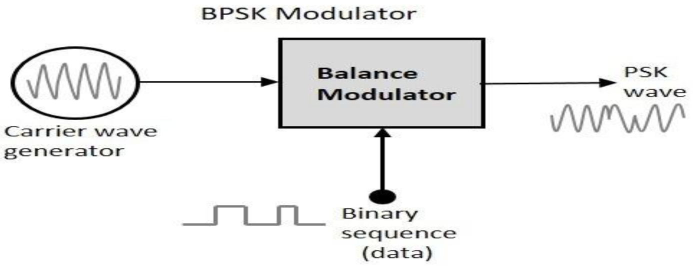

Figure 3: BPSK Modulation.

The modulation of BPSK is done using a balance modulator, which multiplies the two signals applied at the input. For a zero binary input, the phase will be 0° and for a high input, the phase reversal is of 180°.

Following is the diagrammatic representation of BPSK Modulated output wave along with its given input.

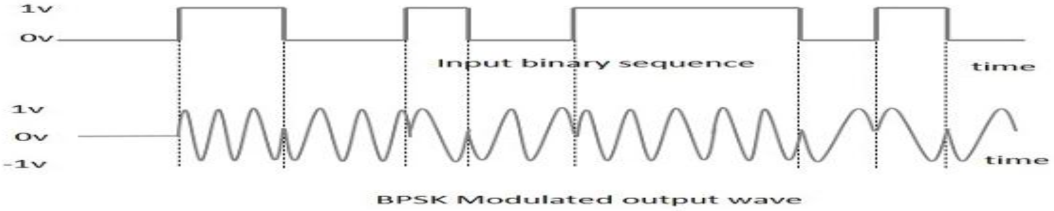

Figure 4: BPSK Modulation Waveform.

The output sine wave of the modulator will be the direct input carrier or the inverted 180°phaseshifted180°phaseshifted input carrier, which is a function of the data signal.

Differential Phase Shift Keying In Differential Phase Shift Keying DPSKDPSK the phase of the modulated signal is shifted relative to the previous signal element. No reference signal is considered here. The signal phase follows the high or low state of the previous element. This DPSK technique doesn't need a reference oscillator. The following figure represents the model waveform of DPSK.

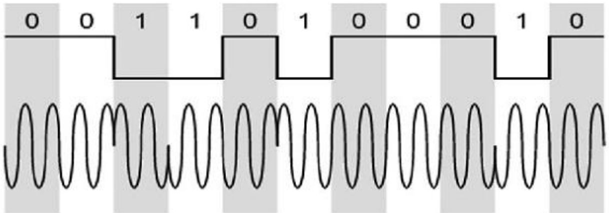

Figure 5: DPSK Modulation Waveform.

It is seen from the above figure that, if the data bit is Low i.e., 0, then the phase of the signal is not reversed, but continued as it was. If the data is a High i.e., 1, then the phase of the signal is reversed, as with NRZI, invert on 1 a form of differential encoding.

If we observe the above waveform, we can say that the High state represents an M in the modulating signal and the Low state represents a W in the modulating signal.

M-ary Equation

If a digital signal is given under four conditions, such as voltage levels, frequencies, phases, and amplitude, then M = 4.

The number of bits necessary to produce a given number of conditions is expressed mathematically as

N=log2MN=log2M

Where

N is the number of bits necessary

M is the number of conditions, levels, or combinations possible with N bits.

The above equation can be re-arranged as

2N=M2N=M

For example, with two bits, 22 = 4 conditions are possible.

Types of M-ary Techniques

In general, Multi-level M−aryM−ary modulation techniques are used in digital communications as the digital inputs with more than two modulation levels are allowed on the transmitter's input. Hence, these techniques are bandwidth efficient. There are many M-ary modulation techniques. Some of these techniques, modulate one parameter of the carrier signal, such as amplitude, phase, and frequency.

M-ary ASK

This is called M-ary Amplitude Shift Keying M−ASKM−ASK or M-ary Pulse Amplitude Modulation PAM.

The amplitude of the carrier signal, takes on M different levels.

Representation of M-ary ASK

$$S_m(t) = A_m cos(2\pi f_c t) \quad A_m \epsilon (2m - 1 - M)\Delta, m = 1, 2 \ldots . M \quad and$$
$$0 \leq t \leq T_s$$

Some prominent features of M-ary ASK are −

- This method is also used in PAM.
- Its implementation is simple.
- M-ary ASK is susceptible to noise and distortion.

M-ary FSK

This is called as M-ary Frequency Shift Keying M−aryFSKM−aryFSK.

The frequency of the carrier signal, takes on M different levels.

Representation of M-ary FSK

$$S_i(t) = \sqrt{\frac{2E_s}{T_s}} \cos\left(\frac{\pi}{T_s}(n_c + i)\, t\right) \qquad 0 \leq t \leq T_s \quad and \quad i = 1, 2, 3 \ldots . . M$$

Where $f_c = \frac{n_c}{2T_s}$ for some fixed integer n.

Some prominent features of M-ary FSK are

Not susceptible to noise as much as ASK.The transmitted M number of signals are equal in energy and duration. The signals are separated by 12Ts12Ts Hz making the signals orthogonal to each other. Since M signals are orthogonal, there is no crowding in the signal space. The bandwidth efficiency of M-ary FSK decreases and the power efficiency increases with the increase in M.

M-ary PSK

This is called as M-ary Phase Shift Keying M−ary PSKM−ary PSK. The phase of the carrier signal, takes on M different levels.

Representation of M-ary PSK

$$S_i(t) = \sqrt{\frac{2E}{T}}\cos(w_o t + \phi_i t) \qquad 0 \leq t \leq T \quad and \quad i = 1, 2 \ldots M$$

$$\phi_i\,(t) = \frac{2\pi i}{M} \quad where \quad i = 1, 2, 3 \ldots \ldots M$$

CONCLUSION

In this paper, the review on digital modulation techniques for wireless communication presented shows that the choice of digital modulation technique is completely application specific and should be chosen carefully. Some applications need a higher precision rate, while some schemes focus on effective utilization of available bandwidth and permissible power for the given application. The quality of service offered by wireless communication systems can be greatly improved by correctly selecting the modulation scheme. Thus, proper selection of digital modulation technique needs to be done to increase radio coverage and power consumption. Some prominent features of M-ary PSK are the envelope is constant with more phase possibilities. This method was used during the early days of space communication. Better performance than ASK and FSK. Minimal phase estimation error at the receiver. The bandwidth efficiency of M-ary PSK decreases and the power efficiency increases with the increase in M. So far, we have discussed different modulation techniques. The output of all these techniques is a binary sequence, represented as 1s and 0s. This binary or digital information has many types and forms, which are discussed further.

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