

## Design and Study of BPSK and BDPSK Communication Systems

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**Keywords:** digital communication system; BPSK; BDPSK.

**Abstract:** Digital communication system has become an important part of modern communication system for realizing integrated service information service and has been used widely. BPSK is an important modulation and demodulation mode of the third generation mobile communication technology. BDPSK can solve the problem that all the output digital signals from decision device is wrong when BPSK is anti-phase operation. In this paper, the design and study of BPSK and BDPSK communication systems are presented. The BPSK and BDPSK communication systems are designed and simulated based on SystemView. The simulation results are correct and practical.

### 1. Introduction

Recently, due to the advantages of humanization and easy to expansion, computers have developed rapidly. In addition, it makes the development of modern communication technology to become more and more perfectly. Because of the advantages of real-time processing, burst transmission, easy to storage and encryption, digital communication systems [1] that can reliably and effectively transmit digital signals becomes an important part of modern communication system for realizing integrated service information service and is widely used in production and daily life. BPSK [2] is an important modulation and demodulation mode of the third-generation mobile communication technology, CDMA2000, WCDMA and TD-SCDMA. BDPSK [3] can solve anti-phase operation of BPSK that makes all the output digital signals from decision device to go wrong and pay attention to security and confidentiality to ensure the security and confidentiality of signal transmission the design and study of BPSK and BDPSK communication systems are discussed. Based on SystemView [4], The BPSK and DPSK communication systems are designed and simulated respectively.

### 2. Design and Study of BPSK Communication Systems

#### 2.1 Operational Principle of BPSK Communication Systems

In BPSK communication system, carrier have two different phases, BPSK sets these two different phases to 0 or 1 logical value. The BPSK modulated signal has a spectrum characteristic that is like that of 2ASK modulated signal. And the bandwidth of the BPSK modulated signal is equal to twice the original modulating signal. The BPSK modulated signal is generally demodulated by using a coherent demodulation method. The operational principle of BPSK communication systems is shown in Figure 1.

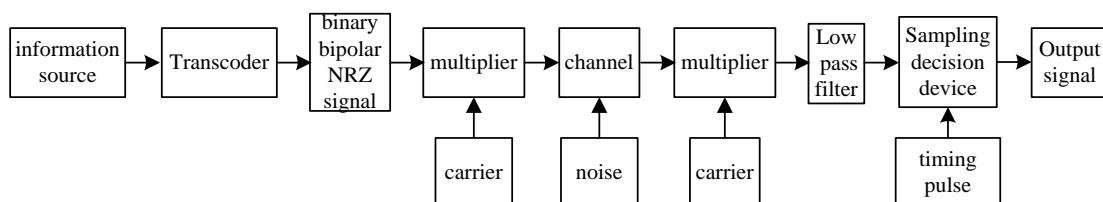


Fig. 1 Block Diagram of Modulation and Demodulation of BPSK Communication System

## 2.2 Design of BPSK Communication Systems based on SystemView

The design of BPSK communication system based on SystemView is shown in Figure 2.

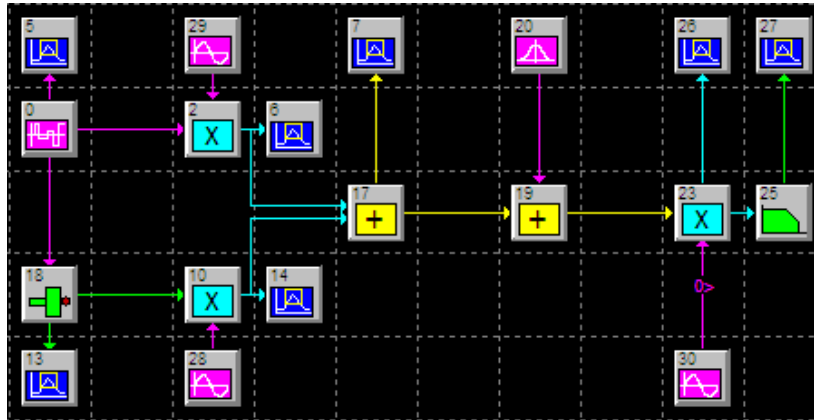


Fig. 2 Design of BPSK Communication Systems

The component parameters of the BPSK communication system are set as follows. Token 0 is the baseband signal that is PN code sequence. Token 18 is an inverse coder. Token 7 and Token 19 are adders. Token 2, Token 10 and Token 23 are multipliers. Token 28, Token 29, and Token 30 are carriers. Token 20 is the Gaussian white noise. Token 25 is a Butterworth analog low pass filter. Token 5, Token 6, Token 7, Token 13, Token 14, Token 26 and Token 27 are analyzing and observing windows.

## 2.3 Simulation of BPSK Communication Systems based on SystemView

After checking the circuit diagram and parameter settings, the simulation operation is carried out. Simulation of BPSK communication systems based on SystemView is shown in Figure 3.

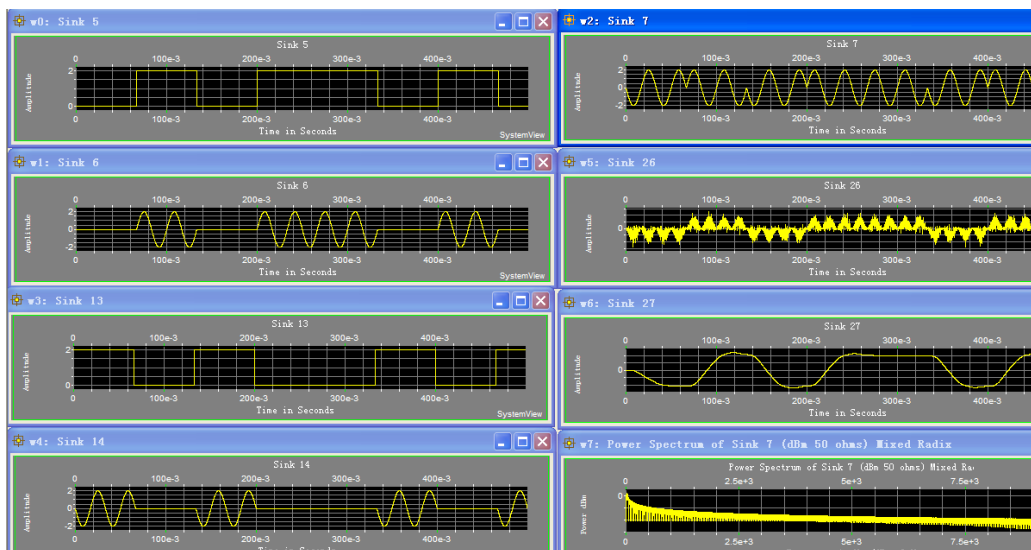


Fig. 3 Simulation Waveform of BPSK Communication Systems

Figure W0 is baseband signal waveform. Figure W1 is the signal that is the result of the baseband signal multiplied by the carrier. Figure W3 is a reverse code of the baseband signal. Figure W4 is the signal that is the result of the reverse code of the baseband signal multiplied by the carrier. Figure W2 shows the BPSK modulated signal. Figure W5 is the BPSK modulated signal added noise. Figure W6 is a baseband signal waveform recovered by coherent demodulation. Figure W7 is the power spectrum analysis of the BPSK modulated signal. In a word, BPSK communication system based on SystemView can realize BPSK communication very well.

### 3. Design and Study of BDPSK Communication Systems

#### 3.1 Operational Principle of BDPSK Communication Systems

There is uncertainty of phases in BPSK signal transmission system, which will cause the confusion and reversal of the received symbols "0" and "1" and produce error codes. In order to have the advantage of BPSK without generating error codes, The BPSK system can be replaced by BDPSK. The BDPSK is a way of representing the digital information using the relative phase values of the front code and the back code. The coherent Demodulation can only be used in BDPSK. Block Diagram of Modulation and Demodulation of BDPSK Communication System is shown in Figure 4.

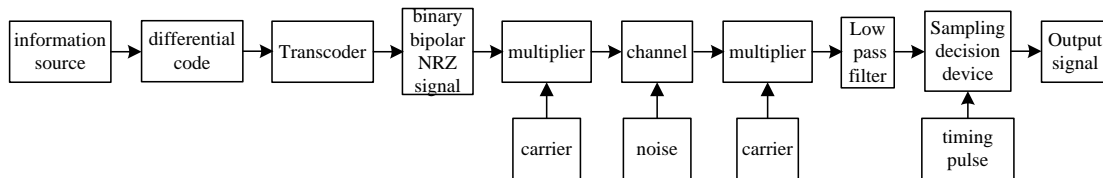


Fig. 4 Block Diagram of Modulation and Demodulation of BDPSK Communication System

#### 3.2 Design of BDPSK Communication Systems based on SystemView

The design of BDPSK communication systems based on SystemView is shown in figure 5.

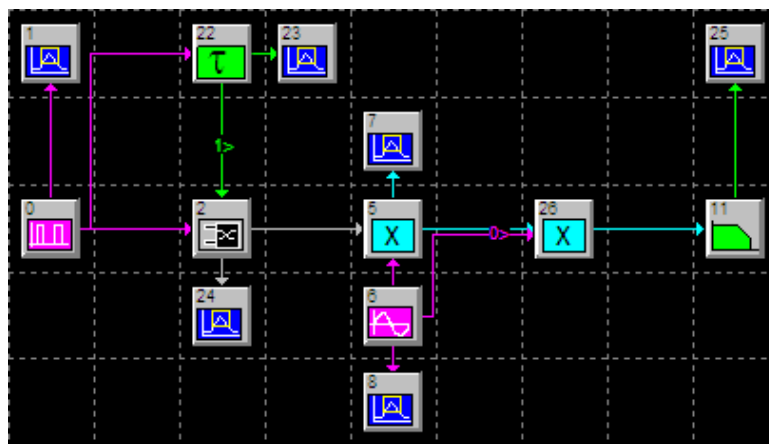


Fig. 5 Design of BDPSK Communication Systems

The component parameters of the BDPSK communication system are set as follows. Token 0 is the baseband signal that is PN code sequence. Token 22 is a delay device. Token 2 is an XOR operator. Token 5 and Token 26 are multipliers. Token 6 are carriers. Token 11 is a Butterworth analog low pass filter. Token 1, Token 7, Token 8, Token 23, Token 24 and Token 25 are analyzing and observing windows.

#### 3.3 Simulation of BDPSK Communication Systems based on SystemView

The simulation of BDPSK communication systems based on SystemView is shown in Figure 6. Figure W0 is the waveform of baseband signal. Figure W3 is the waveform in which the baseband signal is delayed a code. Figure W4 is a binary bipolar NRZ signal of differential codes. Figure W2 is the carrier. Figure W1 shows the BDPSK modulated signal. Figure W5 is a baseband signal waveform recovered by coherent demodulation. It is summarized that BDPSK communication system based on SystemView can realize BDPSK communication well.

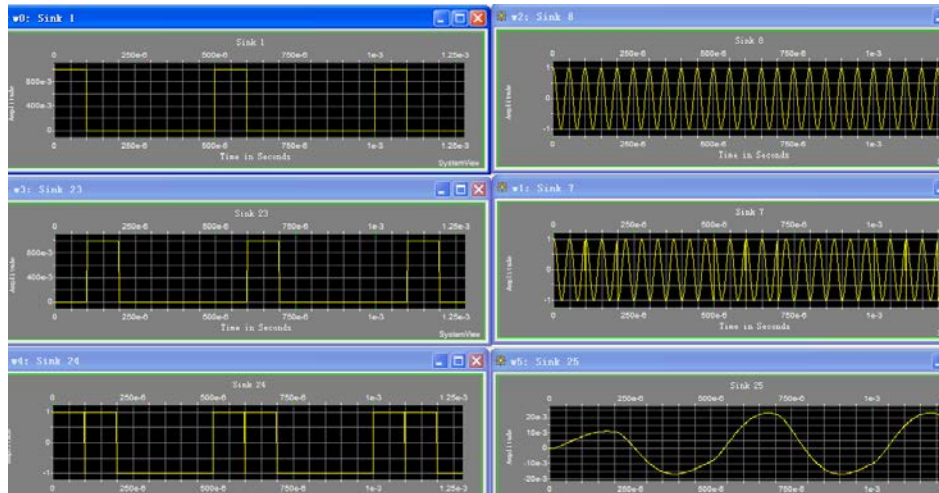


Fig. 6 Simulation Waveform of BDPSK Communication Systems

#### 4. Comparative Analysis of BPSK and BDPSK Communication Systems

The main disadvantage of BPSK is that it is easy to produce phase blur and cause anti-phase operation. In order to overcome this disadvantage, the BDPSK method is proposed. In the process of DPSK demodulation, if the demodulated relative codes produce the inversion phenomenon, the output absolute codes do not have any inversion phenomenon after the inverse code converter, so that the problem of anti-phase operation is solved.

#### 5. Summary

BPSK is an important modulation and demodulation mod. However, the main drawback of BPSK is that it is easy to cause the phase to blurs, anti-phase operation, which makes all the output digital signals from decision device go wrong. BDPSK can solve the problem of anti-phase operation. This paper focuses on the design and study of communication systems of BPSK and BDPSK. The designed and simulation of BPSK and BDPSK are performed by using SystemView. The analysis of this study illustrates the design and study of BPSK and BDPSK communication systems are correct and practical.

#### Acknowledgments

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