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**Experiment 7: QPSK Modulation and Demodulation - Simulink Lab Report**

Quadrature phase shift keying (QPSK) modulated signal includes two independent and orthogonal BPSK signals. The modulated signal can be written as:



In QPSK, unlike BPSK, there are four different phase values, such as , , , and . Thus,for QPSK.

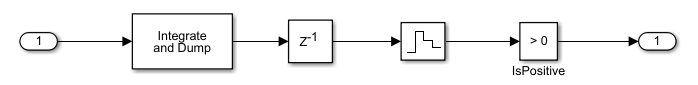
1. **QPSK Bandpass Modulated Signal Model:**

Construct the below block diagrams for QPSK signal modulator and demodulator, respectively. Serial-to Paralel block is not available in the library. The carrier frequency is 1 kHz and also duration is 1/10 Sec.

Diagram

Description automatically generatedSerial-to Paralel block divides bit stream into I and Q channels. Then I channel is multiplied with Cosine carrier and Q channel is multiplied with Sine carrier. Follow the steps below in order and answer the questions.

**Figure 1** QPSK Modulator/Demodulator Block



**Figure 2** Subsystem Block

**Required Blocks**

1. Bernoulli Binary Generator
2. Sine Wave for carrier signal (Form **DSP System Toolbox**)
3. Sum
4. Multiplier
5. is Positive
6. Scope
7. Unipolar to Bipolar converter
8. Delay
9. Zero-Order Hold
10. Bit to integer converter

**Table 1** Parameters for Sine Wave

|  |  |  |
| --- | --- | --- |
|  | **For I-Channel** | **For Q-Channel** |
| **Amplitude** | 1 | 1 |
| **Frequency** | 2\*pi\*5 | 2\*pi\*5 |
| **Phase** | 0 | pi/2 |
| **Sample Time** | 1e-2 | 1e-2 |

1. Run the code for 1 sec. Observe scopes’ outputs and paste these outputs into the below table. What is the bit duration of each I and Q channel? If Bernoulli binary source generates the same bit (all zeros or all ones) during the 8 sec, run again the code. Fill the table. Ignore the first and the last bits.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time Interval | 1-2sec | 2-3 sec | 3-4 sec | 4-5 sec |
| QPSK-TX-DATA |  |  |  |  |
| I data |  |  |  |  |
| Q data |  |  |  |  |

1. In the right Scope, QPSK modulated signal is observed. Please make comments on the I channel, Q channel, and QPSK signal changes. Does the QPSK signal include both I & Q channel changes? Fill the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time Interval | 1-2sec | 2-3 sec | 3-4 sec | 4-5 sec |
| Phase changes on I channel |  |  |  |  |
| Phase changes on Q channel |  |  |  |  |
| Phase changes on QPSK signal |  |  |  |  |

1. When you run simulation, do you recover message correctly? Is there any difference, if existes explain why?