ELEC6831

Project Description

Simulation of a Communications Link

with

QPSK Modulator Convolutional Coding

The simulation should include the following modules:

1) A Source: this is a binary random number generator, generating 0 and 1 with equal probability.

2) A Convolutional Encoder that encodes the bit stream generated in part 1. Use a K=3 code with (7, 5) generator.

3) A QPSK modulator that maps the bit stream into complex numbers representing the amplitude of the QPSK modulator output.

Note that this is simple simulation model and you do not need to simulate the shaping filter or up/down conversion.

4) Channel: A noise generator adding Additive White Gaussian Noise (AWGN) to the filtered data stream.

5) A demodulator recovering the transmitted bit stream, based on the value observed at the output of the channel.

6) A Viterbi decoder working on the output of the demodulator trying to correct demodulator errors (hard decision decoder).

7) A soft decision Viterbi decoder replacing the demodulator and decoder of parts 5 and 6. It will work directly at the output of the channel.

8) An error counter: Simply adding up the errors and finding the probability of error.

Deliverables:

- A brief description of Quaternary Phase Shift Keying (QPSK).
- A brief description of convolutional codes and Viterbi decoding.
- Plot of Bit Error Rate (BER) versus $\frac{E_b}{N_0}$ for QPSK, without coding.
- Plot of Bit Error Rate (BER) versus $\frac{E_b}{N_0}$ for QPSK with coding and hard decision decoding.
- Plot of Bit Error Rate (BER) versus $\frac{E_b}{N_0}$ for QPSK with coding and soft decision decoding.