5 Modulation and Demodulation review

Analog Modulation/Demodulation

1. Obtain a sampled version of a continuous time baseband signal $m(t)$ as the sum of three cosine functions. The amplitudes and frequencies of these cosine functions should be parameters. The maximum frequency content of this baseband signal is limited to 5 kHz.

2. Simulate the following modulators: (a) double side band suppressed carrier (DSBSC) modulation of $m(t)$, (b) Single sideband (SSB-upper) modulation of $m(t)$, (c) plain- amplitude modulation with a modulation index of 60%. Assume that all modulators use a carrier frequency of 20 kHz.

3. Obtain and plot the spectra of the modulated signals.

4. Demodulate the DSB and SSB signals that you have generated above by simulating coherent DSB and SSB modulators. Demodulate the plain-AM signal using both envelope detection as well as coherent demodulation.

Digital Modulation/Demodulation

1. In digital communications, the source is assumed to produce a stream of bits. The bits are usually modelled as an independent and identically distributed random process with the probability of a bit being 1 being 0.5. Generate a random sequence of bits satisfying this property.

2. In digital communications, the above bit sequence is then converted to a baseband signal according to the modulation scheme which is used. The baseband signal is obtained by converting 0 and 1 into appropriate pulses of duration T_b. For the above bit sequence, obtain a baseband signal for BASK and BPSK, with $T_b = 0.1$ seconds.

3. Setup simulations of the following digital communication modulators for modulating the above bit sequence:

   a) BASK with $T_b = 0.1$ seconds and carrier frequency of $10kHz$.

   b) BPSK with $T_b = 0.1$ seconds and carrier frequency of $10kHz$.

   c) BFSK with $T_b = 0.1$ seconds and carrier frequencies of $12kHz$ and $9kHz$.

4. Obtain the spectra of the modulated signal in each case.

5. Setup a simulation of the following demodulator/detectors for the above modulation schemes:

   a) Coherent demodulation and detection for BASK

   b) Coherent demodulation and detection for BPSK

   c) Non-coherent detection for BASK

   d) Non-coherent detection for BFSK