Assignment 4

Performance of Different Modulation types

Submission deadline:

All MATLAB assignments should be submitted by Saturday 21/3/2016 at 23:59, any mail after this date will be directly excluded without exceptions.

Submission mail:

sspdigital2016@gmail.com

Notes:

(1) This mail is for submission only and will be checked only when it is announced that there is a submission.
(2) For questions, queries use my conventional email
kareemattiah@gmail.com
rodaina_gamal@hotmail.com

General rules:

(1) Any copied codes/reports will be awarded “zero” without notification, however doing your best
and trying to follow the shown procedure will usually result in above 50% of total mark.
(2) Any questions, please feel free to contact me by email or via my office hours. I'll be more than happy to lend a hand. However CHEATING is the one thing I can't tolerate nor sympthize with, thanks for your understanding.

(3) Projects sent by mail should have a subject of this format: Lab1_Individual Seat Numbers. For example, a group whose members hold the IDS 10, 11, 12 should have a the following format upon submission: Lab1_{10,11,12}.
(4) The mail attachment should include: 1) One softcopy report with all the requirements arranged in the same order described in this file. Group member's names should be included in a cover page. 2) M-files should be well commented, indented, and properly organized. Variable naming should be self-explanatory and clearly indicating which variable/physical quantity it represents in order to ease the tracing of the code. Please DO NOT include names such as: “toto”, “tete”, “brbr”, etc...!
(5) Overall organization of the report/M-files with logical development as well as following the rules described herein is highly appreciated.

Objective:

Compare the performance of the different modulation schemes(ASK – FSK – PSK).

Theoretical background:

(1) ASK has many cases, but the case we are interested in here is the special case which is called

ON-OFF Keying (OOK).

The simplest and most common form of ASK operates as a switch, using the presence of a carrier wave to indicate a binary one and its absence to indicate a binary zero. This type of modulation is called on-off keying (OOK), here a ‘0’ is represented by having the carrier ‘off’ (i.e. reducing its amplitude to zero), and a by having the carrier ‘on’ (i.e. giving it a chosen amplitude A) by simply switching on and off the carrier. For this reason it is often called *On-Off Keying* (OOK).

(2) PSK has many cases, but the case we are interested in here is the special case which is called BPSK where the phase shift between carrier representing ‘0’ and the carrier representing ‘1’ is 180^{o}.

(3) FSK has many cases, but the case we are interested in here is the special case which is called orthogonal-FSK, in which the 2 transmitted bits are sent on 2 orthogonal carriers.

Procedure:

(4) Simulation parameters:

a. Number of bits/SNR=1e6 bits

b. Signal to noise ratio range=0 to 30 dB with 2 dB steps.

(5) Generate random binary data vector (you can make use of randint or randi).

(6) Modulate the signal according to the type of modulation you want, ex :

OOK : No change in the bits will be required

BPSK: You will have to represent the 1 by 1 and the 0 bit by -1 (i.e you can use this formula :

2*vector_bits-1)

FSK : You will have to modulate the first bit of the bit stream on a certain carrier and the other bit on a carrier orthogonal on it and so on (it can be done by matlab as : symbol=bit1 + i*bit2, where i:is the complex number)

(7) Apply noise to bits (or symbols in case of FSK) (Hint: you must calculate the signal power in this case because it is not unity)

Rx_sequence=bits+noise.

Or

Rx_sequence=awgn(bits,snr,'measured')

(8) Decide whether the Rx_sequence is '1' or '0' by comparing the samples (with threshold=1/2 for OOK and FSK , =0 for PRK) (Hint: try to use relational operators and indexing to make the code more efficient)

(9) Compare the original bits with the detected bits and calculate number of errors (you can

make use of xor or biterr).

(10) Save the probability of error of each SNR in matrix , BER

BER=[BER new prob. of error]

(11) Plot the BER curve against SNR (use semilogy)

Report requirement:

(1) Well commented M-file.

(2) Softcopy report containing required figures (BER figure for all 3 types of modulation on the same figure

(3) Which type of modulation has the best performance?Why?.

(4) At which value of SNR the system is nearly without error (for each type of modulation)?

Bonus:

(1) Evaluate the same curves using the MATLAB built-in function modem.pskmod,

modem.pammod ,……

(2) Evaluate the probability of error of the 16QAM modulation.