COMMUNICATIONS LAB. Experiment #8: Octave Adaptation Experiment

OBJECTIVES

Getting familiar with GNU Octave environment on communications systems signals/simulations.

INFORMATION

Using GNU Octave, we will be generating dense samples of a number of well known signals used in Communication, display them, apply some mathematical operations on them and observe the results throughout the Lab sessions of the Communication Course. Experiments rely on your expertise on the Octave environment. Therefore, this first experiment will get you on track using Octave trough some basic operations.

Modulation, in communication, is to alter one or more properties of the EM wave (our carrier signal). That is, in simulations, we will have one or more basic carrier signal(s) whose dense sample values are in vectors (one dimensional matrices). For example, `y=3*cosd((0:359)*2+45)` will generate 360 samples of a cosine signal in the array `y`. From the expression we understand that its amplitude is 3 and angle is 45 degrees. multiplier 2 indicates that we will have 2*360/360=2 periods of cosine within 360 samples. You may plot the samples as a 1D graph using `plot(y)`. Practice it by changing these parameters and do the following;

EXPERIMENT

a) Construct a 3600 sample cosine signal with 40 periods within. For that your frequency multiplier should be 4 (from f*3600/360=40). Plot it to see if it is correct. Call this signal as "carrier". You may select other parameters as you wish.
b) Construct a 3600 sample sine signal with 2 periods within. Plot it. Call this signal as "message signal". Display both signals on the same graph with different colors, since their sample sizes are the same.
c) Scalar multiply the signals you have just constructed in a and b. For scalar (member by member) multiplication you need to use `.*` operator. Display the resulting signal.
d) Now, add a positive DC bias to the second (message) signal which you have generated in step b. Use a bias value of 0.5. Repeat step c and diplay the resulting signal.
e) Find a bias value so that the signal you have constructed in d is never negative. Repeat the multiplication and display the result again.
f) Now, replace message signal with a square wave of values +1 and -1, 4 periods. Repeat c and e. You need to find out how to generate square wave samples by yourself.
g) Create a new carrier signal, this time let your frequency multiplier be 4.05 (not integer number of periods within the sample array, other parameters are being the same. Plot the frequency contents of both signals on the same graph with different colors. In order to find out the frequency content you need to use fft command and take the absolute value (for display) of the result. Note the difference between components of the two signals. (hint: although the frequency is slightly changed, the graphs have noticeable difference).