AV 331 : DIGITAL SIGNAL PROCESSING

Labsheet – 4

Properties of DFT

1. Compute the 16-point and 32-point discrete Fourier transforms of the 4-point sequence x[n] = [1 0.5 0 -0.5]. Plot their magnitudes and compare them. Now compute the 24-point DFT of the same sequence, then compute the 24-point IDFT of this DFT and compare it with the original sequence x[n].

2. Using MATLAB verify the linearity property of DFT using the following sequences.
   x1[n] = [1 1 0 2 5 7 1 6]
   x2[n] = [3 8 5 2 9 0 3 1]

3. Using MATLAB verify the effect of
   a) circular time shift
   b) circular frequency shift

   on the sequence x[n] = {1 1 2 0.5 0 1 2 1}.

4. State and verify the duality property of the DFT using a rectangular pulse of appropriate width.

5. Consider the following sequences
   x1[n] = [0.59 0.95 0.95 0.59 0.00 0.59 0.95 0.95 0.59 0.00]
   x2[n] = [0.16 0.97 0.96 0.49 0.80 0.14 0.42 0.92 0.79 0.96]
   (a) Find the circular convolution of these sequences using the 'fft' function. Verify your results using the circular 'cconv' function.
   (b) Find the linear convolution of these sequences using the 'fft' function. Verify your results using the 'conv' function.

6. Find the circular correlation of the sequences x1(n) and x2[n] given in the question above using the function 'fft' and verify using the function 'cconv'.

7. Generate $x(n) = \sin(0.2\pi n) + \cos(0.4\pi n)$ and see if the sequence is periodic or not. If yes, select samples from two cycles of x(n) and find the power of the signal. compute the DFT of N sample of x(n) and verify the parseval's relation