

Exercises: Lec. 3

1. From the book "Discrete-Time Signal Processing" (Oppenheim et al.) read p.649 and p.650 and solve problem 8.54.
2. Write a MatLab program to analyse the frequency content of the signal Lecture1.mat. The signal consists of $N=1000$ points and can be analyzed using sines and cosines with frequencies that are multiples of the fundamental frequency $2\pi/N$. The idea is to write your own simple discrete Fourier transform by taking the inner product of the signal with the harmonic functions of all the discrete frequencies k :
$$\exp(-j*2*\pi*n*k/N) = \cos(2*\pi*n*k/N) - j*\sin(2*\pi*n*k/N)$$
In other words: first create a sine and a cosine for all N values of the discrete time n ; then calculate the inner products of the signal with the sine and the cosine, this gives the real and the imaginary parts of the transformed signal; calculate the amplitude (modulus) and phase (argument) of the transformed signal; do this for all 1000 frequencies k (for $k=0:N-1$).