Lab 1

Discrete-Time Signals

Exercise 1 (2 points)

Matlab filename must be `exer01.m`.

Plot the following signal choosing for each one an appropriate range of n: $x[n] = a^n \cdot u[n+3]$, with $a = 0.8162 + 0.4288i$

Plot the signal as a function of the sample number n using:

1. Real and imaginary parts
2. Module and phase

Determine its discrete frequency and the exponential decay rate. If we used a sampling frequency of 125 KHz to generate the discrete signal, determine the analog frequency.

Exercise 2 (2 points)

Matlab filename must be `exer02.m`.

A sampled signal $x[n]$ is defined as $x[n] = 0.75^n \sin(2\pi n/5) \cdot (u[n-7] - u[n+7])$.

Plot the following transformation of $x[n]$:

$$x_b[n] = 2x[n+1] + x[n-3] - x[2n] + x[5-n]$$

Is a Energy/Power signal? Why? Calculate the Energy/Power of $x_b[n]$.

Exercise 3 (2 points)

Matlab filename must be `exer03.m`.

Let $x(t)$ be the following continuous-time signal: $x(t) = \sin(2\pi f_0 t)$, where $f_0 = 50Hz$.

Plot the continuous-time signal in the range $0 \leq t \leq 120ms$ along with the discrete-time signal $x[n]$ that is obtained after sampling $x(t)$ at a rate of 550 Hz.

Note: use a sample rate of 2 MHz to approximate the plot of the continuous-time signal

What's the period N of the discrete signal?
Do the same for a sampling rate of 80 Hz.