

EE 451: Homework 1

1. Write a MATLAB code to generate the sinusoidal sequence given by

$$x(n) = \cos(\omega_0 n)$$

for

- (a) $\omega_0 = 0$
- (b) $\omega_0 = 0.1\pi$
- (c) $\omega_0 = 0.2\pi$
- (d) $\omega_0 = 0.8\pi$
- (e) $\omega_0 = 0.9\pi$
- (f) $\omega_0 = \pi$
- (g) $\omega_0 = 1.1\pi$
- (h) $\omega_0 = 1.2\pi$

use the `stem` function to plot your results and make sure you label all your figures. What conclusion can you draw from these figures regarding the frequency ω_0 .

2. Given the following stochastic signal (in MATLAB notation)

$$x = \text{sqrt}(P_a) * \text{randn}(1, N) + m; \tag{1}$$

where $N = 100,000$

- (a) compute the mean and standard deviation for the following cases
 - i. $P_a = 1$ and $m = 1$
 - ii. $P_a = 3$ and $m = 2$
 - iii. $P_a = 2$ and $m = 3$
 - iv. $P_a = 4$ and $m = -5$
- (b) Use MATLAB to compute the average power for the signal x under for the values listed in (2a).
- (c) What is the relationship between the average power and the values of P_a and m .
- (d) Write a MATLAB code to filter the stochastic process given by Equation (1) through a moving average of the form

$$y(n) = \frac{1}{M} \{x(n) + x(n-1) + \dots + x(n-M+1)\}$$

using $M = 5$ and $M = 10$ and using the parameters in (2a). What is the impact of the filter on the mean and the standard deviation?