

## EE 521: Homework 3

1. Given a random process described by

$$X(t) = A \cos(2\pi f_0 t + \theta) \quad (1)$$

where  $A$  is a constant, and  $\theta$  is a uniform random variable in the range of  $-\pi/4$  to  $\pi/4$ .

- Plot the pdf of  $\theta$ .
  - Compute the first and second moment statistical averages.
  - Compute the statistical autocorrelation.
  - Is this process wide sense stationary?
  - If the process is wide sense stationary, is it ergodic?
2. Given a random process described by

$$X(t) = A \cos(2\pi f_0 t + \theta) \quad (2)$$

where  $A \sim G(0, \sigma^2)$  and  $\theta$  is a uniform random variable in the range of  $-\pi$  to  $\pi$ .

- Compute the first and second moment time averages.
  - Compute the first and second moment statistical averages.
  - Compute the statistical autocorrelation.
  - Is this process wide sense stationary?
  - If the process is wide sense stationary, is it ergodic?
3. Given a lowpass RC filter (shown in Figure 1) with a white Gaussian noise input with power spectral density  $S_n(f) = \frac{1}{2}N_0, -\infty < f < \infty$ , compute

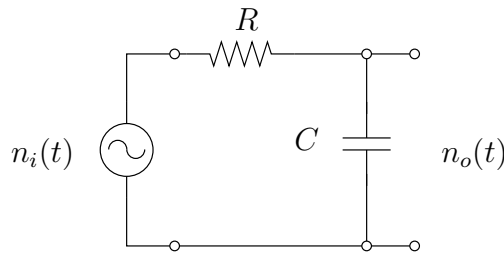


Figure 1: Lowpass RC filter

- the transfer function of the filter,
- the power spectral density of the output,
- the mean and variance of the output, and
- the pdf of the output.