Y_2

EECE442 Homework set #1

Problem #1 Let the random variable Y be defined by

$$Y = \begin{cases} X, & X \geq 0 \\ 0, & X < 0 \end{cases}$$

The random variable X is Gaussian distributed with zero-mean and variance σ_x^2.

Determine the probability density function of Y.

Problem #2 A Gaussian distributed random variable X with zero mean and variance σ_X^2, is transformed by a square-law device into

$$Y = X^2.$$

Determine the p.d.f. of Y.

Problem #3 Consider the random process

$$X(t) = A\cos(\omega_c t + \Theta)$$

where Θ is a uniformly distributed r.v. between $[0, 2\pi]$.

Determine $R_X(\tau)$, $R_X(0)$, m_X, $S_X(\omega)$.

Problem #4 Consider the random Process

$$X(t) = A\cos(\omega_c t + \Theta).$$

A is a Gaussian r.v. with zero-mean and variance σ_A^2. Θ is uniform in $[0, 2\pi]$. A and Θ are statistically independent.

Determine $R_X(\tau)$, m_X, $K_X(\tau)$, $S_X(\omega)$.

Problem #5 Consider the process

$$X(t) = A\cos\omega_c t$$

where A is $N(0, \sigma_A^2)$.

This process is applied to an integrator producing

$$Y(t) = \int_0^t X(\tau)\, d\tau.$$

a) Determine whether $X(t)$ is stationary or not.
b) " The p.d.f. of $Y(t)$ at $t = T$.
c) Determine whether $Y(t)$ is stationary.

Problem #6 A process $X(t)$ has

$$R_X(\tau) = \exp\{-2\nu|\tau|\},$$

where ν is a constant. $X(t)$ is applied to an RC low-pass filter. Determine $S_Y(\omega)$, $R_Y(\tau)$. $Y(t)$ is the filter output.