

Εργασία 1^η

Consider $X(k)$, given by

$$X(k) = W(k) - W(k - 1), k = \pm 1, \pm 2, \dots,$$

where $\{W(k)\}$ is a stationary stochastic process with independent, identically distributed (i.i.d) stochastic variables and $E\{W(k)\} = 0$, $E\{W^2(k)\} = 1$ and $E\{W^3(k)\} = 1$. The covariance sequence of $\{X(k)\}$ is given by:

$$\begin{aligned} c_2^x(\tau) &= m_2^x(\tau) = E\{X(k)X(k + \tau)\} \\ &= E\{(W(k) - W(k - 1))(W(k + \tau) - W(k + \tau - 1))\} \\ &= 2\delta(\tau) - \delta(\tau - 1) - \delta(\tau + 1) \end{aligned}$$

where $\delta(\tau)$ is the delta Kronecker function; hence,

$$c_2^x(\tau) = \begin{cases} 2, & \tau = 0 \\ -1, & \tau = 1, \tau = -1. \\ 0, & elsewhere \end{cases}$$

The corresponding Power Spectrum is given by

$$C_2^x(\omega) = \sum_{\tau=-1}^1 c_2^x(\tau) e^{-j\omega\tau} = (2 - 2\cos\omega).$$

1. Find the 3rd-order cumulants of $\{X(k)\}$, i.e., $c_3^x(\tau_1, \tau_2)$.
2. Find the skewness $\gamma_3^x = c_3^x(0,0)$. What do you observe?
3. Find the Bispectrum $C_3^x(\omega_1, \omega_2)$ Is it complex, real or imaginary?
4. How the result of 2 affects the result of 3? Can you draw a general comment?