Tutorial 4
Random Signal Analysis

Problem 1 (Transmission through LTI)

Prove that if a WSS process $X(t)$ with mean μ_X and auto-correlation function $R_X(\tau)$ passes through an LTI system with impulse response $h(t)$, the output process is also a WSS process with:

1) Mean: $\mu_Y = \mu_X \int_{-\infty}^{\infty} h(t)dt = \mu_X H(0)$

2) Autocorrelation: $R_Y(\tau) = R_X(\tau) * h(\tau) * h(-\tau)$

3) Power Spectrum: $G_Y(f) = G_X(f) \, | H(f) |^2$

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Problem 2 (Power)

Determine the power of the following random signals:

1) $X(t)=X$, and X is a uniform random variable over $[-A/2, A/2]$.

2) $X(t) = \sum_{n=-\infty}^{\infty} Z_n \cdot v(t - nT_0)$

where $Z_n=Z$ is a discrete random variable and $v(t)$ is a deterministic signal with duration T_0, i.e., $v(t)\neq 0$ if and only if $|t| \leq T_0 / 2$.